PUBLIC WORKS

city county and state

February 1950

LEADERS IN THE PUBLIC WORKS FIELD

Arthur H. Niles: President of the Federation of Sewage Works Association, a position that he has earned by long and outstanding service, Arthur Niles is engineer-superintendent, Division of Sewage Disposal for Toledo, Ohio. After a civil engineering degree from Michigan, he served in the Corps of Engineers in World War I, participating in five major engagements. With broad experience in city engineering work, he was the answer to a city's prayer when Toledo started its new sewage treatment plant in 1932; and we think he still is.

some of the articles in this issue:

One-Way Grid System Solves Traffic Problems

Small Sewage Treatment Plant for an Airport

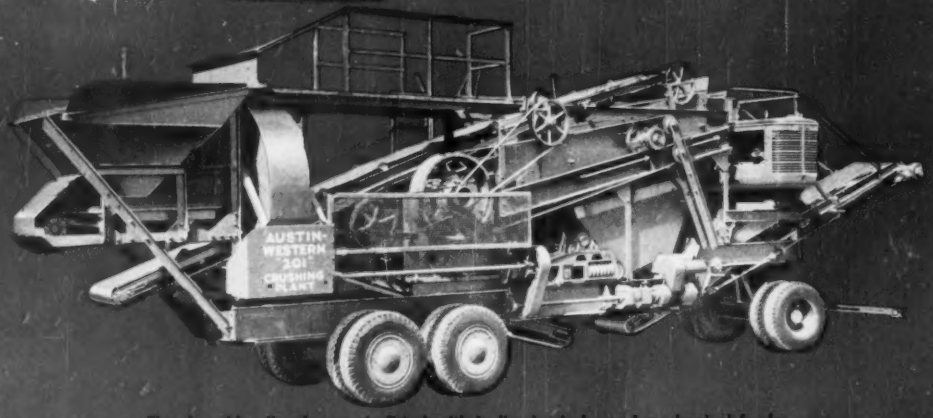
Ground Water Storage and Discharge

Designing Better Inlets for Highway Drainage

Small Surface Water Supply Problems

Complete Contents Listed on page 5

The New "201" Crushing and Screening Plant



The shovel-loading hopper is fitted with inclined grizzly, and mechanical feeder. All principal units are shaft and V-belt driven. Notice the fully-enclosed brakes.

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HIGH OUTPUT. With its jaw and roll crushers, the "201" is capable of producing especially large amounts of ¾" and smaller product.

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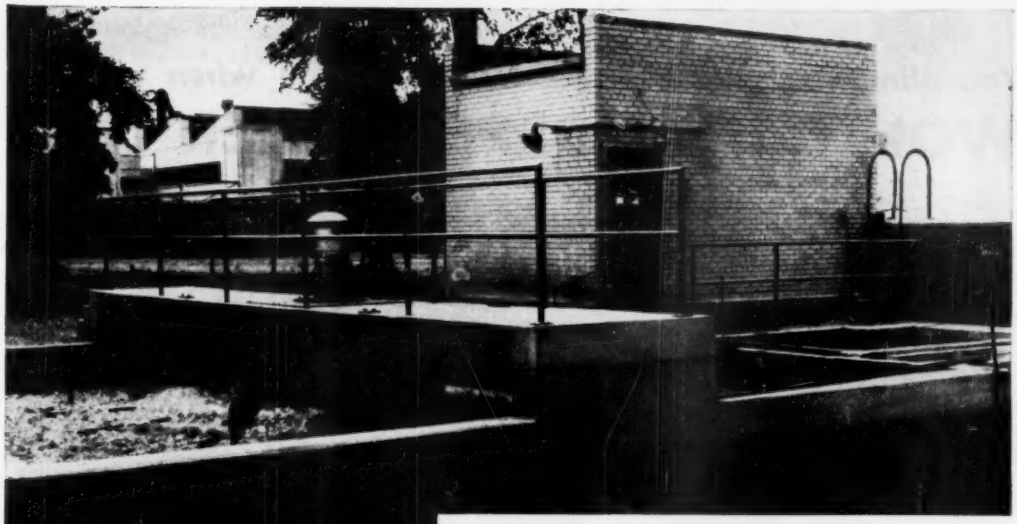

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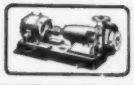

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FEBRUARY 1950

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THE ENGINEERING AUTHORITY IN THE CITY-COUNTY FIELD

Edited by
W. A. HARDENBERGH and A. PRESCOTT FOLWELL

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THE EDITOR'S PAGE

Safety Procedures for Maintenance Workers

FIELD maintenance on highways, sewers, streets and water facilities will soon be with us, now that winter—we hope—is on the way out. Experience has shown that the accident rate among maintenance workers is inordinately and unnecessarily high. In addition to the normal hazards of construction, most maintenance operations are subject to the dangers of traffic.

Accident rates for maintenance operations can be reduced markedly by utilizing the accumulated knowledge available through those organizations that specialize on insurance covering accidents for such work. Now is the time to determine to lower your accident insurance rate on maintenance work this summer. It can be done, and it will reduce, not increase costs.

The insurance companies have not done a good job in selling a safety program to municipalities and counties, so if you want to find out what should be done, you will probably have to take the initiative and go after the information. Your editor has tried repeatedly to get articles telling precisely how to set up safety practices; many requests are unanswered; others result in vague promises which have rarely materialized.

We suggest that you designate one of your smart young engineers as the man responsible for initiating proper safety measures. After all, that is an excellent way to get things done.

Chronology of a Water Shortage

PROBABLY most of the country has read of New York City's water shortage—its citizens read of it on the front page of every daily paper, in the subways and wherever else they turn their eyes. Citizens and even the governor of the State put the blame on the city's Board of Water Supply. The water departments of many other cities can sympathize with the Board and may be interested in the following facts, which parallel the experiences of many of them.

In 1921 the Board began a study for an augmented supply. In 1927 it presented a plan for use of water from the Delaware river. In 1928 this plan was approved by the city's Board of Estimate, and 7 days later the Board of Water Supply asked the approval of the State Water Power Commission, which was granted 16 months later. Meantime New Jersey asked the U. S. Supreme Court for an injunction against withdrawal of water from the Delaware river. Two years later, in 1931, the injunction was denied and New York was free to begin construction. But the depression was then at its worst and the city could not sell the bonds necessary. In 1936 funds became available to start work, and good progress was made on work which, it had been estimated in 1926, would take 20 years. But the war slowed down the work and, by 1941, had stopped it completely. In 1944 the city tapped Rondout Creek for a supply of 100 mgd to relieve the shortage which it saw was imminent. Construction on the Delaware river supply was renewed in 1946 and is continuing at good speed. In 1947 the Board of Water Supply warned that immediate steps should be taken to conserve the present supply; and that, unless this were done, even the addition of the Delaware river supply would not prevent a shortage within a very few years, and plans for a new supply should be begun immediately.

Perhaps, with the present emergency to spur all concerned, progress will be made on the proposed plans. Perhaps the city can even be persuaded to install meters, which would be effective in reducing the present large use of water.

Better Housing Sanitation on Construction Jobs

THOSE who had first-hand information on the shocking lack of sanitation and housing that prevailed at almost every one of the big camp construction jobs during the recent war have felt that such conditions should never again be permitted. They existed because of the lack of realization of what would happen—lack of construction experience—by army construction authorities, and lack of authority on the part of civilian consultants. Some in the army, including your editor, tried to remedy or mitigate these conditions, but without much success. Housing, water supply and waste disposal for the construction men were in many cases no better than, if as good as, those that prevailed during the siege of Troy some three milleniums ago. Now we have hope for new tools for better construction project living. Trailer manufacturers have brought out a mobile bunkhouse to house ten men, with bathing, toilet and living quarters. Such trailers can be used for road construction, as well as for other jobs where men must be taken care of. Now we need a water supply trailer to assure safe water. These new devices won't solve all of our problems on construction jobs, but they will help. And they, or others equally as good, should be required on public works construction jobs by federal, state, county or local authorities.

The First Annual Report for 1949 Reaches Us

MOST annual reports reach us from 6 to 12 months after the end of the year. It is refreshing, therefore, to have received on Jan. 6 a preview copy of "Progress Report on Public Water Supplies, Sewage Works and Stream Pollution Control in Georgia for 1949." This report was dated Jan. 3, and it brings us up to date on Georgia accomplishments for the past year. It was signed by W. H. Weir, Public Health Engineer for the State of Georgia. Those who know Col. Weir and are familiar with his accomplishments during the war will not be surprised that this job has been done promptly and thoroughly. It is characteristic of him to do things that way.

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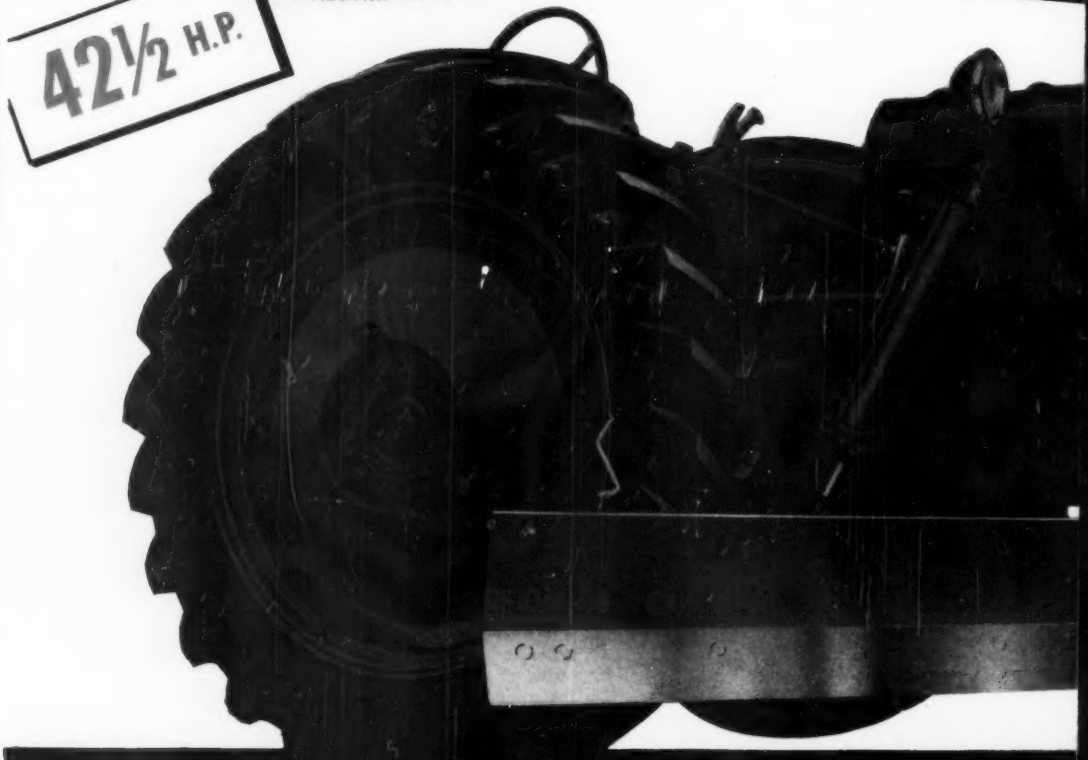

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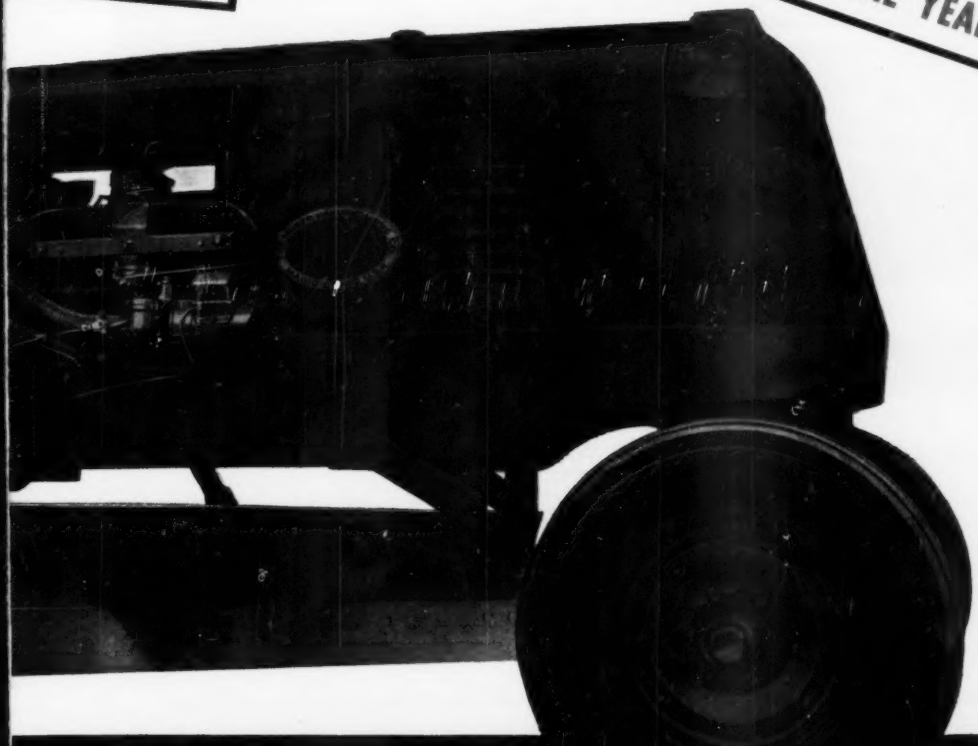

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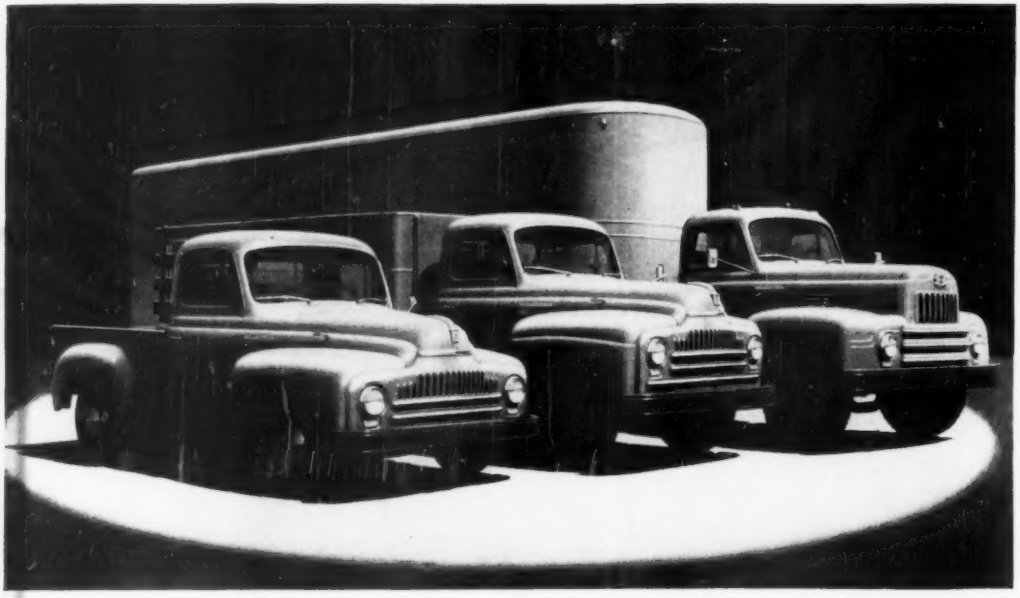

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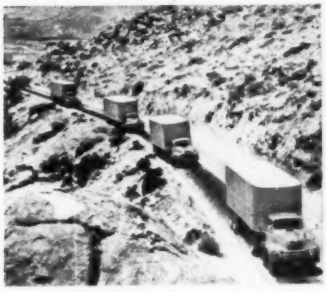

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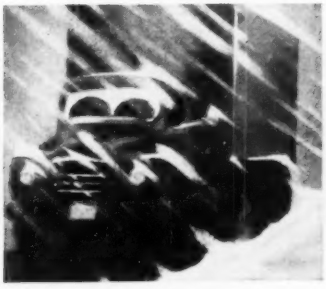

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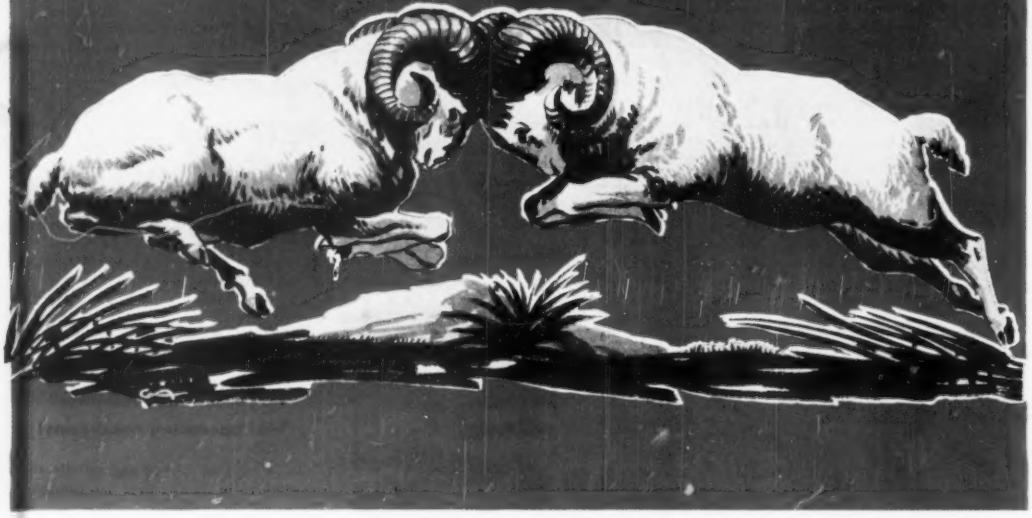

Without shock strength—or, for that matter—without all of the strength factors listed opposite—no pipe laid 100 years ago in *city streets* would be in service today. But, in spite of the evolution of traffic from horse-drawn vehicles to heavy trucks and buses—and today's vast complexity of subway and underground utility services—cast iron gas and water mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada. Such service records prove that cast iron pipe combines all the strength factors of long life with ample margins of safety. No pipe that is provably deficient in any of these strength factors should ever be laid in city streets. Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3.

CAST IRON PIPE

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Strength factors of Long Life !

No pipe that is provably deficient in any of these strength factors should ever be laid in city streets

SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

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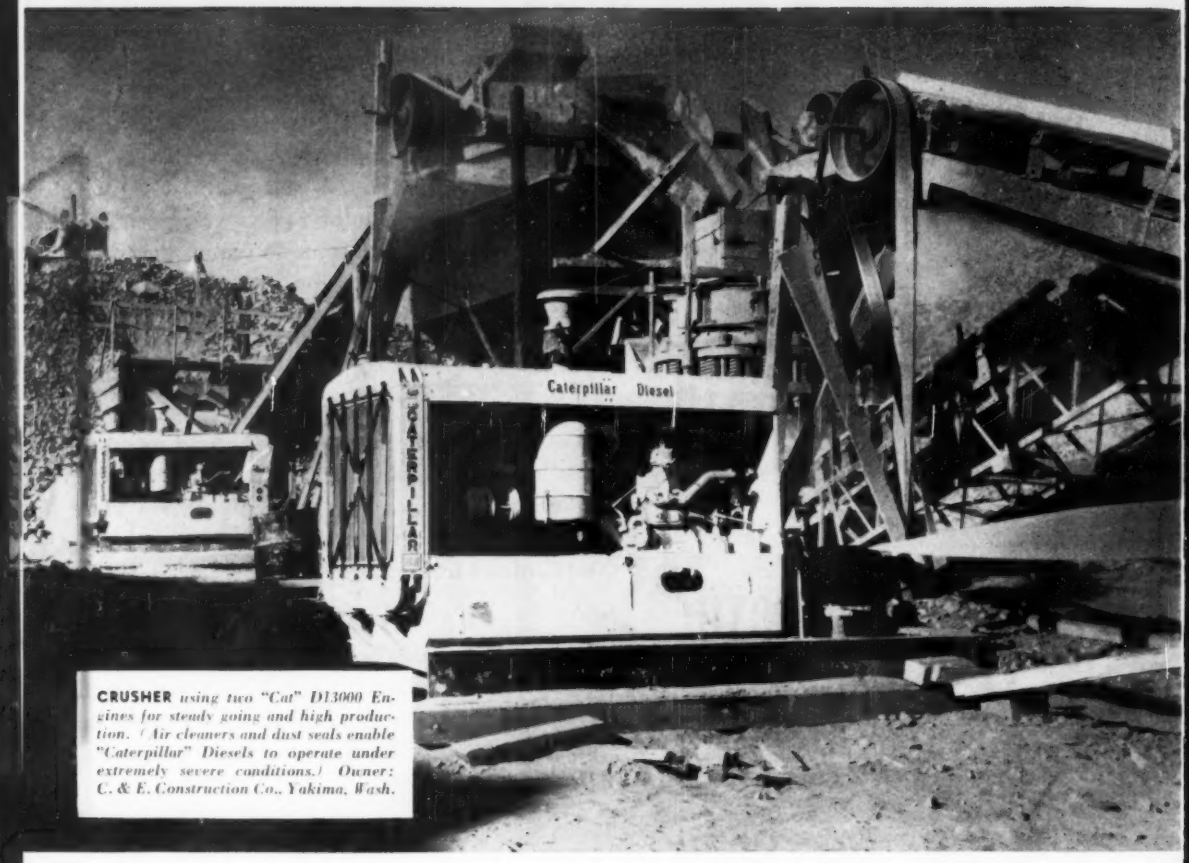

CRUSHER *using two "Cat" D13000 Engines for steady going and high production. (Air cleaners and dust seals enable "Caterpillar" Diesels to operate under extremely severe conditions.) Owner: C. & E. Construction Co., Yakima, Wash.*

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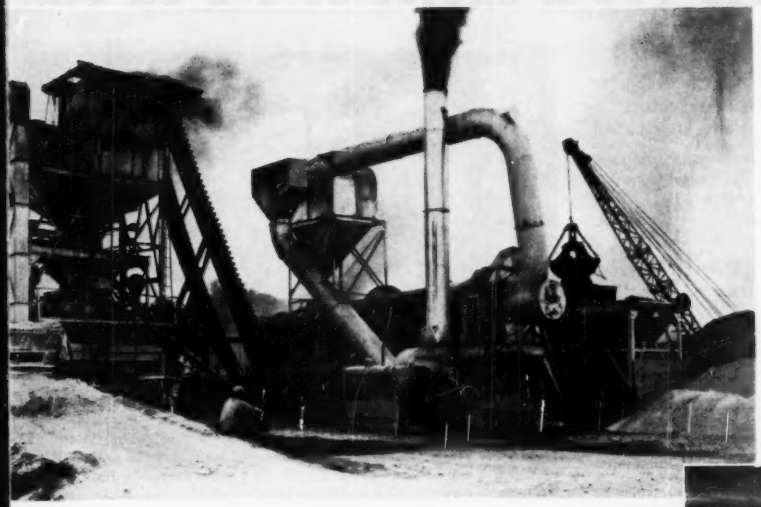
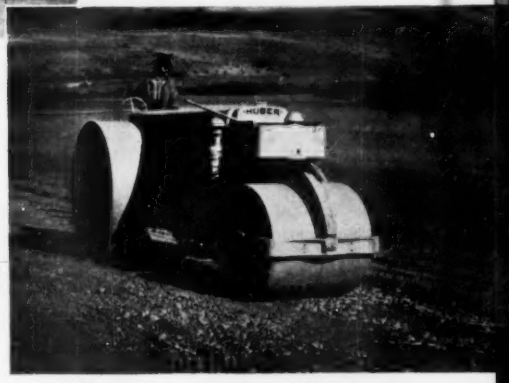


ASPHALT PLANT. *Hopper and dryer dependably powered by a "Cat" D13000. Record day's output, 1503½ tons. Owners: Payne & Dolan of Wisconsin, Milwaukee, Wisconsin.*

ROLLER *(ten-ton) on compacting detail, powered by a "Caterpillar" D4400 Diesel Engine. Owner: Union County Road Dept., La Grande, Oregon.*



LOOK UNDER THE HIDE

Connecting rod and main bearings must be strong enough to carry maximum horsepower output. They must also resist corrosion which can be caused by lubricating oil additives and the products of oil breakdown. Exclusive with "Caterpillar" Engines are heavy-duty, precision-type, aluminum bearings. These bearings run cooler, are non-corrosive, offer the best in strength. Their development is an advanced step over the use of babbitt and copper-lead bearings. Look under the hide for quality!

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ONLY FORD GIVES YOU A CHOICE OF V-8 OR SIX

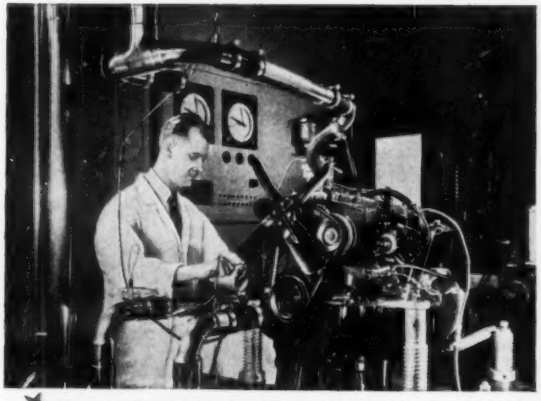
The Ford Truck line for 1950 gives you new models, new ratings, new power, new features—21 smart ideas in all, to help cut trucking costs.

NEW MODELS like the F-3 Parcel Delivery, which expand the 1950 Ford Truck line to over 175 models. This wide selection means that you should see your Ford dealer for the right truck for you, no matter what you haul. New G.V.W. rating increase on Series F-6 and F-8.

NEW POWER like the brand-new 6-cylinder Rouge 254 truck engine. Thus, for 1950 you have a choice of four great engines, two Sixes, and the only two V-8's in trucking. Only Ford gives you a choice of V-8 or Six.

NEW FEATURES like the full air brakes now available on the 1950 F-8 Big Jobs . . . single-speed axles for the F-6 and F-8 . . . new Synchro-Silent transmissions . . . new features that make driving safer and easier.

New models! New ratings! New power! New features! You'll find all these smart ideas in Ford Trucks for 1950. And you'll find the smartest idea of them all . . . Bonus Built construction which means big reserves of strength and power. That's why a 1950 Ford Truck is the smart buy for you. Your Ford Dealer can arrange quick delivery on most models. See him today!



★**NEW 110-HORSEPOWER SIX!** The new Rouge 254 makes the 1950 Ford F-6 the most powerful 6-cylinder Ford Truck ever built. The thoroughly proved 254 has Free-Turn exhaust valves, Autothermic pistons, chrome-plated top piston ring, High-Lift camshaft, and many other power-producing, cost-saving, smart ideas. ★A brand-new, 4-speed Synchro-Silent transmission engineered for quiet operation, easy shifting and long life is standard with the new 254 engine.

Model F-2; 5,700 lbs. G.V.W. Express or Stake

Model F-1; 4,700 lbs. G.V.W. Panel, Pickup or Stake

Model F-3; 6,800 lbs. G.V.W. Express or Stake

Model F-5; 14,000 lbs. G.V.W. Wheelbases; 134, 158 and 176 in.

Model F-4; 10,000 lbs. G.V.W. with Duals

Model F-3 Parcel Delivery Wheelbases; 104 and 122 in.

America's No. 1 Truck Value!

No. 1 in sales gains. Registration figures show Ford Trucks are scoring bigger sales gains than *all other makes combined*, based on the latest three months, compared to the first three months of 1949!

No. 1 in choice of engine types. Only Ford gives you a choice of V-8 or six-cylinder engine design.

No. 1 in experience. Latest registrations prove that 2,003,155 Ford Trucks on the road have marked up 18,567,865 truck years of experience . . . a record equalled by no other truck.

No. 1 in long life. Using latest registration data on 6,106,000 trucks, life insurance experts prove Ford Trucks last longer.

No. 1 in value. Over 175 models! The only V-8's in trucking! Two 145-h.p. Big Jobs rated up to 39,000 lbs. They're Bonus Built which means big reserves of strength and power.

Ford Trucks Cost Less Because—

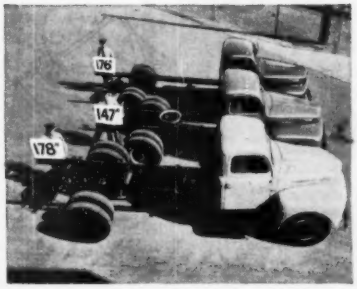
When you need special information—consult READERS' SERVICE DEPT. *on pages 93-97.*

for 1950!*

—IN A FULL LINE OF OVER 175 TRUCK MODELS!

★ **NEW F-7 REAR BRAKES!** Big 15" x 5" hydraulic, dual cylinder. High torque self-centering action both forward and reverse.

★ **NEW AIR BRAKES** available on the Ford Series F-8 Big Job combine smooth flexibility with immediate, positive action.



★ **NEW WHEELBASES!** Three of them for 1950 Ford Trucks. Series F-5 and F-6 now have a 176-in. wheelbase for bodies in the 15-ft. range. The 145-horsepower Ford Big Jobs have added two new wheelbases to get a total of five. First, a 147-in. wheelbase for tractors and dump trucks. Second, a 178-in. wheelbase for 15-ft. bodies.

★ **NEW PARCEL DELIVERY!** Forward control chassis with grille, windshield and quarter-windows. You add your choice of bodies. Available in Series F-3 and F-5 (Special order).

★ New single-speed rear axle for F-8 ★ New extra-heavy duty clutch with 254 engine ★ Million Dollar Cab ★ Air Wing door glass ventilators ★ Level Action cab mounting ★ New Double Channel frame for Big Jobs ★ Gyro-Grip Clutches ★ New single-speed axle for F-6 ★ Roll Action Steering ★ New extra H. D. drive line with 254 engine ★ Quadrax rear axles ★ 4 engines—choice of V-8 or Six ★ New heavy duty, 3-speed Synchro-Silent transmission available for F-1 thru F-3 ★ Choice of over 175 models ★ Bonus Built construction.

One of many 145-horsepower Ford F-8 Trucks operated by Michigan Motor Freight Lines, Inc. of Detroit, Mich.

Model F-5 Cab-Over-Engine
14,000 lbs. G.V.W.

Model F-5 School Bus Chassis
Wheelbases: 158 and 194 in.

Model F-6 Cab-Over-Engine
16,000 lbs. G.V.W.

Model F-6; 16,000 lbs. G.V.W.
Wheelbases: 134, 158 and 176 in.

Model F-7; 19,000 lbs. G.V.W.
35,000 lbs. G.T.W.

Model F-8; 22,000 lbs. G.V.W.
39,000 lbs. G.T.W.

FORD TRUCKS LAST LONGER

Using latest registration data on 6,106,000 trucks, life insurance experts prove Ford trucks last longer!

When writing, we will appreciate your mentioning PUBLIC WORKS

ICE and SNOW REMOVAL COMBINATION

to keep your winter drivers happy:

Rock SALT + Nalco 818-C

TESTS last winter proved that on city streets where *no ice control materials* were used, corrosion rates were *higher* than where rock salt treated with Nalco 818-C kept streets clear and clean!

And with rock salt and 818-C there is no abrasion problem . . . no costly cleanup in spring . . . no complaints from motorists of corrosion damage to automobiles . . . or bitter letters concerning accidents caused by ineffective ice control methods.

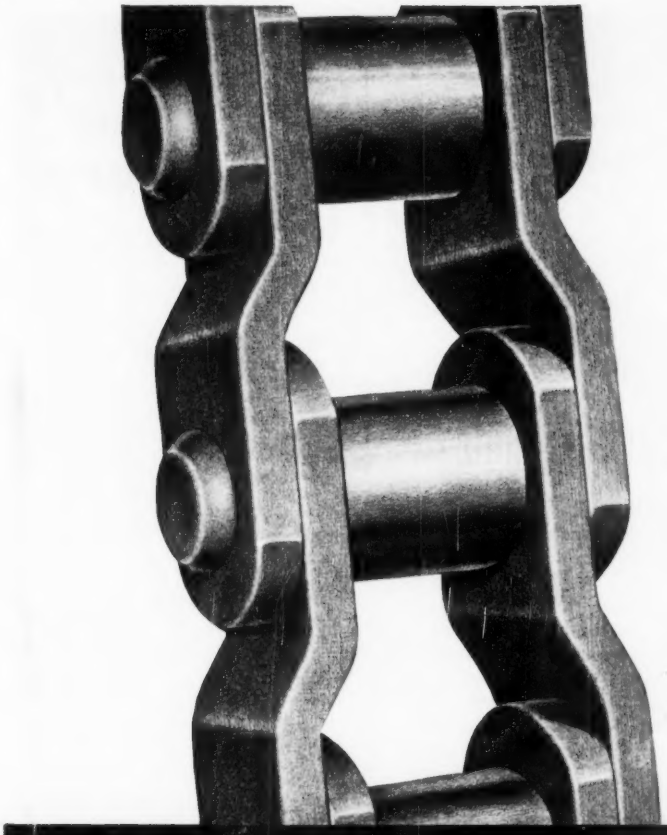
Nalco 818-C protects any bare metal surface with a microscopic film which keeps slush, water and corrosive chemical solutions from attacking the metal. Mixed with rock salt in relatively minute quantities (one pound or less per 100 lbs. of rock salt), 818-C protection, plus rock salt ice control efficiency is the ideal combination for safe, damage-free winter driving.

Write for Nalco Bulletin 44, containing technical data on results of 818-C in use.

NATIONAL ALUMINATE CORPORATION
6198 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem, Limited, Burlington, Ontario, Canada

A Nalco **PRODUCT . . . Serving America through Practical Applied Science**

When you need special information—consult READERS' SERVICE DEPT or page 93-97.



A section of Steel Thimble Roller Chain. When you have need for such chains — call on Jeffrey, their originator.

CHAINS are important but often they are given little consideration until all else is accounted for. Whether for conveyors, elevators, other unit machinery or for driving purposes — correctly designed chains are highly essential. Chain is one of our earliest products — we know how to build it exceptionally well. A complete line — also attachments, sprockets and transmission machinery.

THE JEFFREY MANUFACTURING COMPANY Established 1877

947 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

JM

Baltimore 2 · Birmingham 3 · Boston 16 · Buffalo 2 · Chicago 1 · Cincinnati 2 · Cleveland 13 · Denver 2 · Detroit 13 · Harlan · Houston 5 · Huntington 19 · Jacksonville 2 · Milwaukee 2 · New York 7 · Philadelphia 3 · Pittsburgh 22 · St. Louis 1 · Salt Lake City 1 · Scranton 3

When writing, we will appreciate your mentioning PUBLIC WORKS

Having SLIDE RULE trouble?

When the problem is moving air or gas, turn to *R-C dual-ability* for accurate, dependable answers

That's one job we know, inside-out. For almost a century, we've been air-and-gas specialists, exclusively. Without being immodest, we think our engineers are the best informed in the industry, on blowers, exhausters, gas pumps and related equipment.

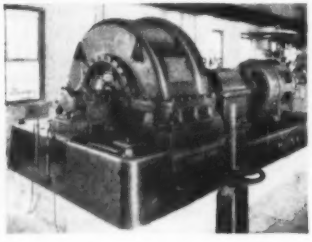
They have an extensive line to draw on, too. They make unbiased recommendations between Centrifugals and Rotary Positives—we're the only company offering this *dual choice*. With capacities ranging from 5 cfm to 100,000 cfm, we can supply standard units closely matched to the job, for efficiency and economy.

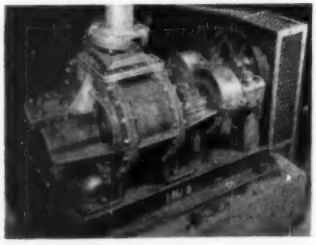
As to how R-C equipment performs, our old-time, repeat customers are the best answer to that. They'll testify that you will reduce your buying and operating problems when you call on R-C air-and-gas specialists.

ROOTS-CONNERSVILLE BLOWER CORPORATION
502 Poplar Avenue, Connersville, Indiana

CENTRIFUGAL

2-stage Centrifugal Blower with capacity of 13,500 cfm, in sewage treatment plant.





ROTARY

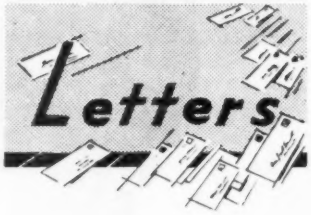
Rotary Positive Blower used in water treatment process. Capacity 300 cfm.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

When you need special information—consult READERS' SERVICE DEPT. on pages 93-97.



KEEPING TRASH OFF ROADSIDES

Your editorial regarding the keeping of trash off roadsides may offer a solution to an area-wide problem which the Pomona Valley faces. An Area Beautification Committee was formed about two months ago, and one of the first problems that the members face is that of roadside litter.

I am sure that the City of Claremont, together with all of the interested persons in the Pomona Valley, would appreciate any information regarding small roadside sanitary fills. Your editorial did not mention the county which is at present using these fills. Will you please advise me where I may obtain further information and more detailed information about these sanitary fills?

Keith A. Murdock,
City Manager
Claremont, Calif.

(Ed. Note: We believe the county referred to in the December editorial was Davidson Co., Tennessee, of which Nashville is the county seat. Basic information came to us from Charles L. Crangle, State Planning Commission, Nashville).

STREET SWEEPING AND FLUSHING

We are much interested in performance data from other cities on street sweeping and flushing operations. If you have information compiled we would appreciate learning the average number of gutter miles swept during an 8-hour shift of work. If this information includes the make or type of sweeper, we would appreciate having that information, too.

We would also like to have data on the various types of flushers and what is considered the most practical size, as well as the average number of miles of streets covered by flushers in an 8-hour shift.

We read your magazine every month and pass it along to the vari-

DEMPSTER-DUMPSTER SYSTEM SOLVES BULK REFUSE PROBLEM

Garbage and rubbish disposal in Baltimore's market areas, which was becoming a sanitation problem and for years defied solution, has now been solved by the Dempster-Dumpster System of bulk rubbish collection. Baltimore Bureau of Sanitation officials agree that results have been outstanding and a definite economy has been realized.

Dempster-Dumpster containers, of 10 cu. yd. capacity, have been placed at key points where garbage, litter, discarded produce and rubbish are deposited immediately as they accumulate. When the doors to the fireproof container are closed, no rats can reach the refuse . . . no flies can contaminate it . . . no wind, scavengers or domestic animals can scatter it. As each container is filled it is picked up, hauled away, dumped at the disposal area and returned to the market by a Dempster-Dumpster truck hoisting unit. One hoisting unit services a large number of these containers.

The Dempster-Dumpster principle—quick pick-up of pre-loaded containers—can be applied not only in market places, but wherever bulk refuse accumulates . . . such as hospitals, apartment houses, schools . . . and at tremendous savings for any city. Write today for the complete Baltimore story.

DEMPSTER BROTHERS INC.

Photos show one of the first Dempster-Dumpster units at work in Baltimore. The conveniences of the Dempster-Dumpster System have encouraged citizens to take a personal interest in public sanitation, and have made it easy for them to keep the market areas clean.

920 DEMPSTER BLDG. KNOXVILLE 17, TENN.

A NECESSITY FOR EVERY MUNICIPALITY

The NETCO CATCH BASIN CLEANER with pneumatic controls

Simple • Positive Powerful

PNEUMATIC BUCKETS

Two types of Netco Buckets are available with large capacity: (1) An orange peel type which operates through an opening as small as 16 inches. (2) a clamshell designed to operate through rectangular frames as small as 13½" x 19".

Check these features

- The Netco Catch Basin Cleaner can be mounted on any short wheel base truck having at least 8 ft. in back of cab. You can purchase unit separately and mount on your own chassis.
- The Netco Unit can be removed from truck and chassis in 30 minutes.
- The Netco can be operated continuously because the material removed from catch basins is loaded into other trucks. This unit will average 20 to 30 catch basins per 8 hour day.
- The Netco Bucket closes pneumatically, assuring positive and maximum digging efficiency.
- Positive and simple control of pneumatic bucket, boom swing, hoist clutch and boom brake by compressed air.
- The Bucket is lowered and raised by one cable. Only one hose is required to close it, and it is opened by powerful spring action.
- The Netco has a hoisting capacity up to 1500 lbs.

These Cities and Many Others Own One or More
Netco Catch Basin Cleaners

Boston, Mass.
New York City, N. Y.
Indianapolis, Ind.
New Brunswick, N. J.
Harrison, N. J.
East Cleveland, Ohio
Binghamton, N. Y.
Chicago, Ill.
Philadelphia, Pa.
Niles, Ohio

NETCO DIVISION
CLARK-WILCOX COMPANY
118 Western Avenue
Boston 34, Massachusetts

When you need special information--consult READERS' SERVICE DEPT. *on pages 93-97.*

ous department heads who also read the entire magazine.

Vernon Thorpe,
City Superintendent,
Medford Ore.

(Ed. Note: We hope that those of our readers who have the kind of information that Mr. Thorpe asks for will send it to him promptly. A copy to the Editor will be appreciated).

TRICKLING FILTERS

PUBLIC WORKS Magazine has published, in 1947 and 1948, articles on high rate and standard trickling filters, which afterwards were compiled in the Handbook of Trickling Filter Design. This will undoubtedly prove of much interest to the professional men in charge of the General Administration of the Sanitary Works of the Argentine Nation, to which Department I belong.

I have been asked to translate this assembly of articles into Spanish for publication in the "official" magazine of this Administration. Please inform me whether you will authorize the translation and its publication in "Obras Sanitarias de la Nacion," without any charge. If so, kindly let me know how many copies of the translated article you would like.

Edmondo R. Gellon,
Direccion Principal de Estudios y Protectos
Obras Sanitarias de la Nacion,
Bueonos Aires,
Argentina.

(Ed. Note: Permission granted).

BOOKS IN BRIEF

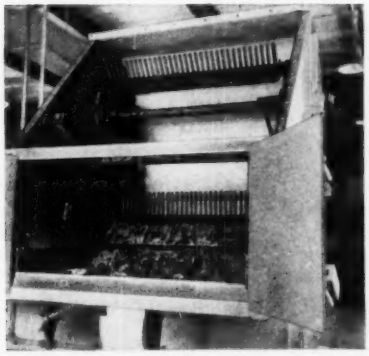
PAVEMENT THICKNESS

This bulletin, issued by the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., presents and discusses methods of computing the thickness, for various loadings, of flexible pavements. The methods used by most of the states are shown; also airport runway design methods used by the Corps of Engineers, by the CAA and by the Canadians.

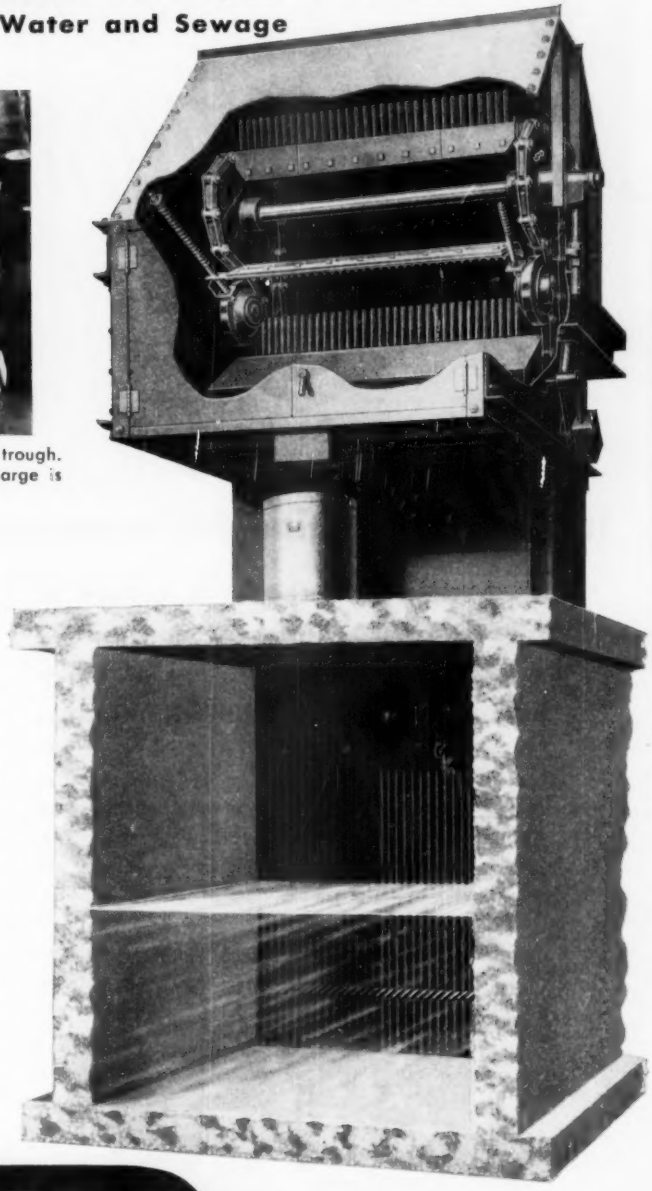
FROTH FLOTATION FOR INDUSTRIAL WASTES

This is a brief bulletin describing the use of froth flotation for separating near-colloidal particles from a saturated brine; for treating cannery, meat packing, distillery, paper mill, fibre and other wastes; and for

The New "THRU-CLEAN" BAR SCREEN Efficiently Removes Trash and Large Solids from Water and Sewage



Refuse being discharged on the screenings trough. The clean rakes at top show that discharge is very thorough.



Investigate the new Link-Belt Mechanically Cleaned Bar Screen, and observe how the rakes clean thru the bars from the back.

This screen has many distinctive features. Bottom and top support of screen bars assures alignment. Vertical path cuts down the power required to operate and results in minimum chain wear. Chain take-up is on the head shaft where it is readily accessible for maintaining proper chain tension. The screen cannot be jammed by large objects settling in front of the screen bars since the rake will enter under and lift them.

The screen is of the usual rugged Link-Belt design and is accurately constructed to give long life under the most severe operating conditions. For detailed information, get in touch with our nearest office.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

11,738

When writing, we will appreciate your mentioning PUBLIC WORKS

Your Assurance

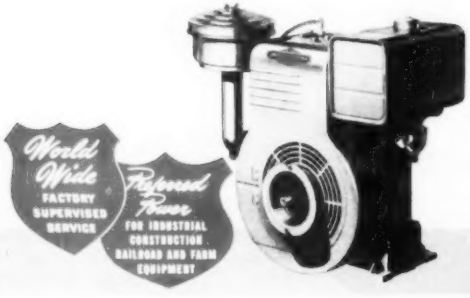
4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

Of All That Is Best
In Gasoline Engine Performance

. . . backed by experience gained in more than 30 years of continuous production and the building of more than 4 million air-cooled engines.

There are more Briggs & Stratton engines in service than all other makes of gasoline engines in their field combined —proof that they are "preferred power" the world over. Insist on Briggs & Stratton 4-cycle, single-cylinder, air-cooled engines to power your equipment.

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wisconsin, U. S. A.



When you need special information—consult READERS' SERVICE DEPT. *on pages 93-97.*

BOD reduction. A copy will be sent on request to Dept. 1623, Denver Equipment Co., Denver 17, Colo.

ROADSIDE CONTROL

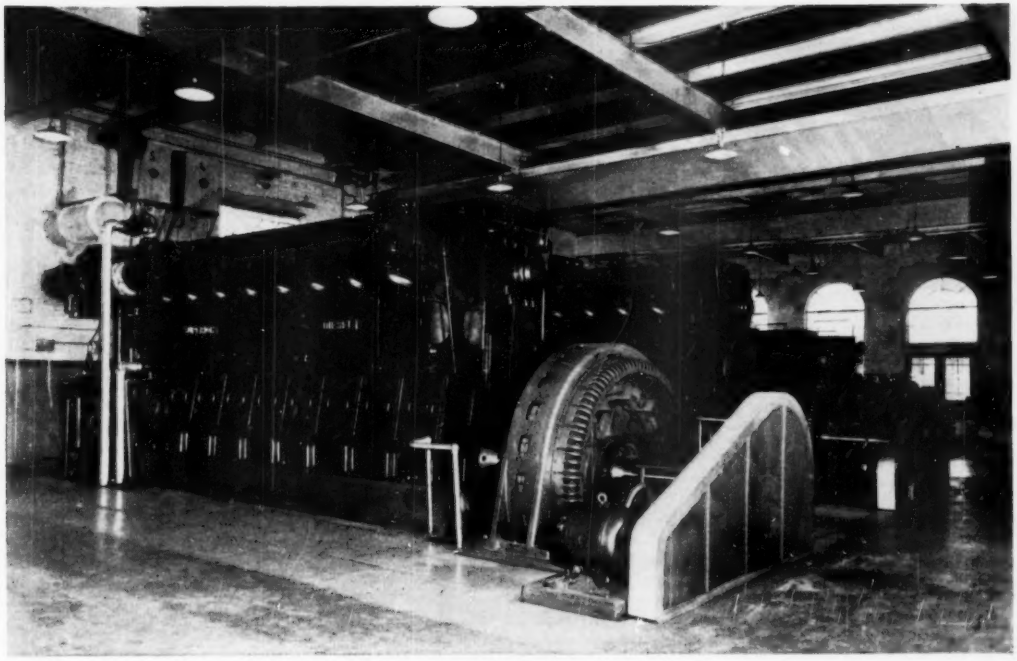
This Bibliography on Roadside Control was compiled by the Bureau of Public Roads. It is intended to serve as an aid to highway planners and administrators. Listings are arranged by states and chronologically. There are special sections on outdoor advertising, set-back regulations and roadside zoning. Write ton, D. C.

ROUTE SURVEYS

This seems like an excellent book, covering all of the important fields of surveying. The application and use of aerial surveys is given some attention, and the details of ground surveying are explained thoroughly. Illustrations of methods of doing the work and of methods of keeping notes are very helpful. Illustrative examples are used throughout. The publisher says that this book presents a new and unique approach to the treatment of simple circular curves by both arc and chord definitions in parallel. The chapter of spiral curves includes not only the AREA method, but also the recently accepted highway spiral. There are excellent and complete tables. The author is R. R. Skelton, Professor of Civil Engineering, University of New Hampshire. The publisher is McGraw-Hill Book Co. Including tables, etc., there are 524 pages. Price is $4.50.

HOME SEWAGE DISPOSAL

This 260-page report, the first of a series on "Studies on Household Sewage Disposal Systems," presents findings on 1) a literature review; 2) controls and practices by local health units; 3) the operation of test experimental tanks; 4) field studies of sludge and scum accumulations; 5) the use of sludge and yeast as starters; 6) the effect of zeolite softener salts on digestion; and 7) freezing of tanks and disposal fields in cold weather areas. The information given affords a good background for the consideration of this problem of household sewage disposal. No information is given as to how to get a copy of this report. We suggest writing the Public Health Service, Environmental Health Center, Cincinnati, Ohio.



THEY BURNED THE MORTGAGE IN LESS THAN 10 YEARS

● An Arkansas town started a power generating plant over 10 years ago with three Superior Diesels. When they threw the switch on this new venture they had a $49,000 debt. In less than 10 years they burned the mortgage.

Since this municipal power plant started operations, it has paid over $122,000 in power dividends to the city . . . in free street lights, and 80% discounts to schools, churches, and charities. They added another Superior Engine in 1945 . . . still another in 1946 . . . and bought their sixth Superior Diesel in 1949.

In addition to these dividends and necessary capital improvements, operating profits made it possible to repeal a special tax assessment. Today this Arkansas power plant is debt-free and making a substantial annual profit. Its customers get the lowest priced electrical power in the locality.

Careful supervision plus low cost Diesel power have added another remarkable success story to Superior's files. Chances are a Superior representative can help you accomplish the same results. Why not write and tell us when he should call, or if you prefer, send for our fully illustrated 20-page booklet.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

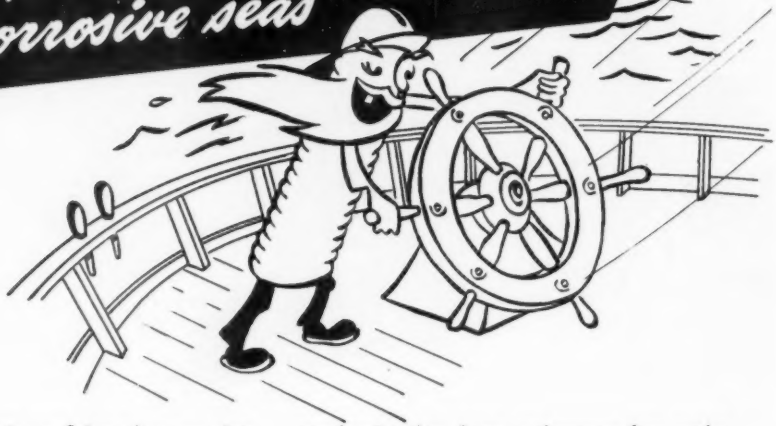
THE NATIONAL NSCO SUPPLY COMPANY

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

When writing, we will appreciate your mentioning PUBLIC WORKS

This pipe is an "Old Salt" in corrosive seas



Corrosion storm signals are flying when any pipe goes out to sea. Yet hundreds of installations prove that Armco ASBESTOS-BONDED Pipe takes salty seas in stride. That's because it is built to withstand severe corrosive service.

Whether it's sewage, industrial wastes or some other corrosion problem, Armco ASBESTOS-BONDED Pipe affords utmost protection inside and out. The base metal is protected by asbestos fibers, securely embedded in the galvanizing and impregnated with a special bituminous seal coat. This protective material won't break or crack off. It is rotproof and non-deteriorating. Long, maintenance-free service is assured.

ASBESTOS-BONDED Pipe is just one of the many Armco Corrugated Metal Structures designed to meet your specific drainage needs. There is PAVED-INVERT Pipe to combat erosion, PIPE-ARCH for limited headroom, MULTI-PLATE for small bridges or large stream enclosures and culverts. You choose the exact structure you need for economy and service.

Write us for complete data. Armco Drainage & Metal Products, Inc., 2260 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation.

Export: The Armco International Corporation.

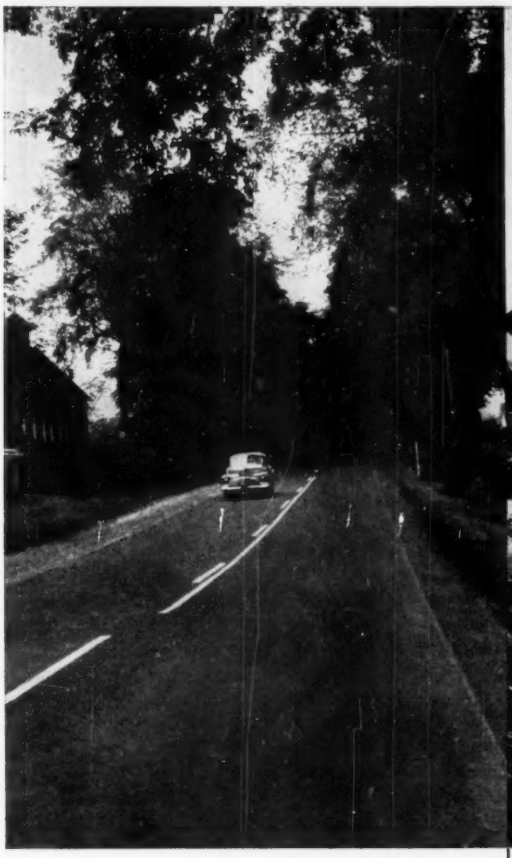
Armco Drainage Structures

ARMCO

Launching an outfall sewer of Armco ASBESTOS-BONDED Pipe across a salt marsh.

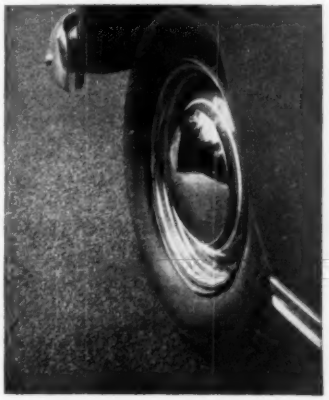
When you need special information—consult READERS' SERVICE DEPT. *on pages 93-97.*

The kind of road people like to ride on — Summer or Winter



When hot Summer suns burn down, motorists appreciate the smooth non-glare surface of roads built with Tarvia* road tar. These roads are always pleasant to look at—pleasant to drive on. They harmonize with any landscape.

When Winter storms come, roads built with Tarvia* road tar are easier to keep open. That's because their black surface absorbs heat and you can use calcium chloride or sodium chloride on them without damage.



Tires get a better grip on Tarvia* road tar pavement. The slightly granular, "tractionized" surface gives them a firm tread-hold.

Barrett's 46 years of experience in road building, maintenance and repair is yours for the asking. *Ask the Barrett field man.*

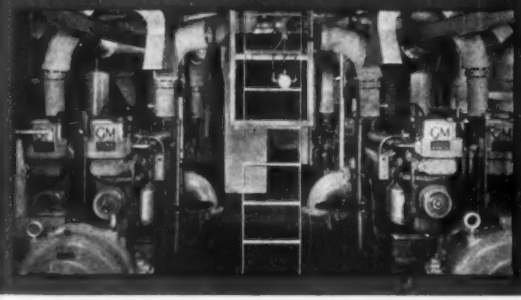
THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

New York • Chicago • Birmingham • Detroit
Philadelphia • Boston • Rochester • Columbus
Youngstown • Ironton, O. • Syracuse • Buffalo
Bethlehem, Pa. • Portland, Me. • Bangor, Me. • Norwood, N. Y. • Oneonta, N. Y. • Elmira, N. Y. • Cromwell, Conn. • Norwich, Conn.
In Canada: THE BARRETT CO., LTD., Montreal
Toronto • Winnipeg • Vancouver

Barrett* Tarvia* ROAD TAR

*Reg. U. S. Pat. Off.

There's a new Trend in Fireboats



All over the country, the trend is to smaller, more flexible fireboats of greater pumping capacity—and General Motors Diesel power

BOSTON last Spring converted two 97-ft. boats into 7000 g. p. m. pumpers with GM Diesel engines for pumping power. Over a period of three months, these two boats saved over $100 a day in fuel over the old steam pumpers.

SEATTLE modernized two larger fireboats, one gasoline powered and one steam, by installing 6 "Twin 6" Diesels built by General Motors in each boat for pumping.

PHILADELPHIA bought a new 75-ft. 6000 g. p. m. fireboat built around a GM Diesel "Quad 6" engine. And almost immediately ordered two more like it.

HOUSTON Fire Department officials studied Philadelphia's new boats and had the R.T.C. Shipbuilding Company turn out one for them. Same plans, same power—the GM Diesel 800 H.P. "Quad 6".

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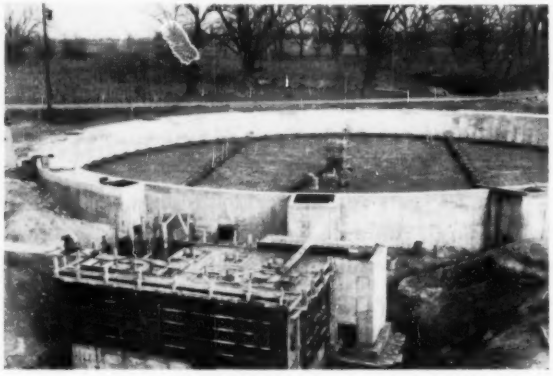
TODAY'S FILTER PLANTS use vitrified clay filter bottom blocks

"Here's how we are improving and modernizing the three sewage treatment plants at Sedalia, Mo.," says Allan H. Wymore, Des. Engr., Burns & McDonnell Engineering Company.

ALLAN H. WYMORE
Designing Engineer
BURNS & McDONNELL ENGINEERING CO.

The Burns & McDonnell Engineering Company, Kansas City, Missouri has for fifty-one years been engaged in consulting services, nearly 2500 projects, including electric power, water treatment and distribution, and sewers and sewage treatment. These projects have been scattered throughout United States, Canada, Alaska and Mexico. Of the three sewage treatment plants now being modernized at Sedalia, one was designed by this Company in 1911, another in 1916 and the third in 1928. The first of these plants is being replaced almost entirely. Original construction is being utilized in the expansion of the other plants.

"At the south plant all structures will be new including a trickling filter 100 feet in diameter and 6 feet deep. At the north plant there will be a new trickling filter 75 feet in diameter and 6 feet deep. All plants provide for recirculation of the filter effluent. The south plant has a normal rated flow of 0.5 mgd. It consists of circular primary and secondary clarifiers, a single filter, and a single digester. A concrete control station is provided, which contains heating



South plant showing floor of vitrified clay filter bottom blocks

and gas equipment, digester piping, and lavatory. The structure in the foreground of the picture is the pump station, where the filter effluent is to be pumped to the secondary clarifier. The plant is expected to be completed about March, 1950."

FILTER FLOORS in Sedalia's new trickling filters are built of *vitrified clay filter bottom blocks* made by members of the Trickling Filter Floor Institute and specially designed for best operating results. Specify them on *your* next plant too. For full engineering details write any member of this Institute today.

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See all the various sizes of International crawler and wheel tractors at your local International Industrial Power Distributor's showroom. Let your Distributor help you choose the right size tractor for your city or town. You'll find International tractors are an important asset to any community.

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Ten Years Ago...

A Decade of ATLAS DURAPLASTIC AIR-ENTRAINING PORTLAND CEMENT

in August, 1939, this concrete test paving was laid in Second Avenue North, Minneapolis. The badly scaled section of roadway in the background was made with regular portland cement. The foreground section, *laid at the same time*, was made with Atlas Duraplastic—the first commercial use of the air-entraining portland cement originated and developed by Universal Atlas.

Both sections, subjected to the severity of ten Minneapolis winters and to heavy applications of de-icing salts, are shown above as they appeared in July, 1949—convincing proof of the characteristic durability of Duraplastic concrete, of its high resistance to freezing-thawing weather and the scaling action of de-icing salts. Longitudinal structural crack shows some ravelling. Note perfect transverse joint.

Today.... No doubt of *durability*... in concrete paving made with ATLAS DURAPLASTIC*

Penn-Lincoln Parkway, Allegheny County, Pittsburgh, Pa. Concrete for paving bridges, underpasses made with Atlas Duraplastic. White concrete reflecting median divisors made with Atlas White Duraplastic. Designed by Pennsylvania Dept. of Highways; Contractor: Johnson, Drake & Piper Co., New York

From its initial installation to the succeeding score upon score of successful paving installations over the past ten years, there is abundant evidence that Atlas Duraplastic cement fortifies concrete against freezing and thawing — renders it highly resistant to the scaling action of de-icing salts.

Clinching proof was revealed at the first session of the American Concrete Institute Convention held in New York in February, 1949 Devoted to "problems in concrete paving surface durability," the session recorded a significant unanimity of opinion that air-entrained concrete resists pavement scaling from salt treatment. A leading construction magazine commented, "... the use of entrained air, insofar as designers and contractors are concerned, would seem to admit of no more argument than the use of the water-cement ratio."

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PW-D-93

ATLAS DURAPLASTIC

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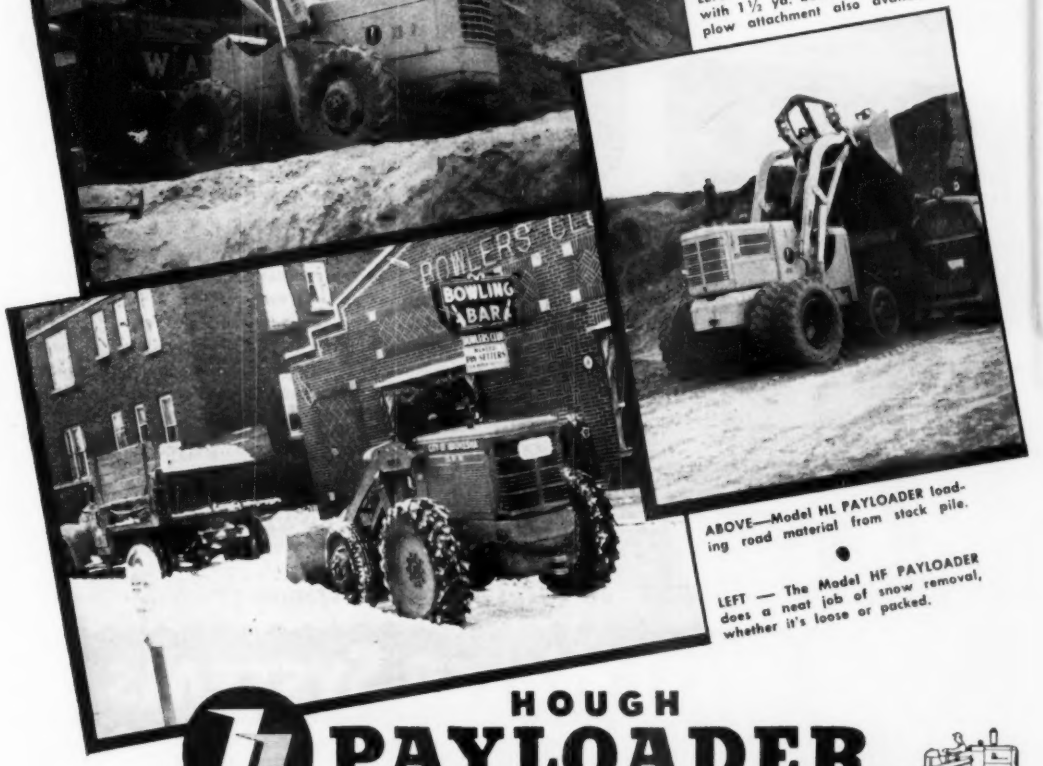
LEFT — Model HM PAYLOADER with 1½ yd. bucket. Big V snow plow attachment also available.



ABOVE—Model HL PAYLOADER loading road material from stock pile.

LEFT — The Model HF PAYLOADER does a neat job of snow removal, whether it's loose or packed.

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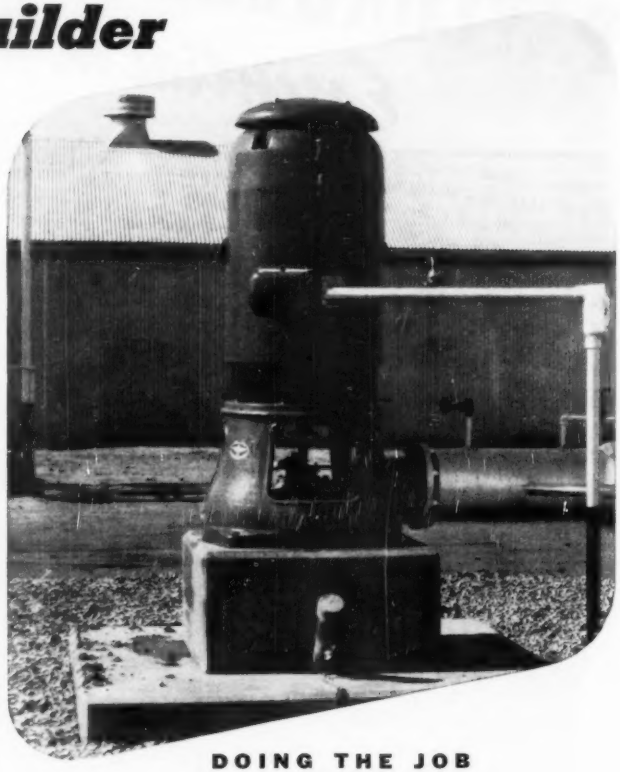

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PUBLIC WORKS MAGAZINE

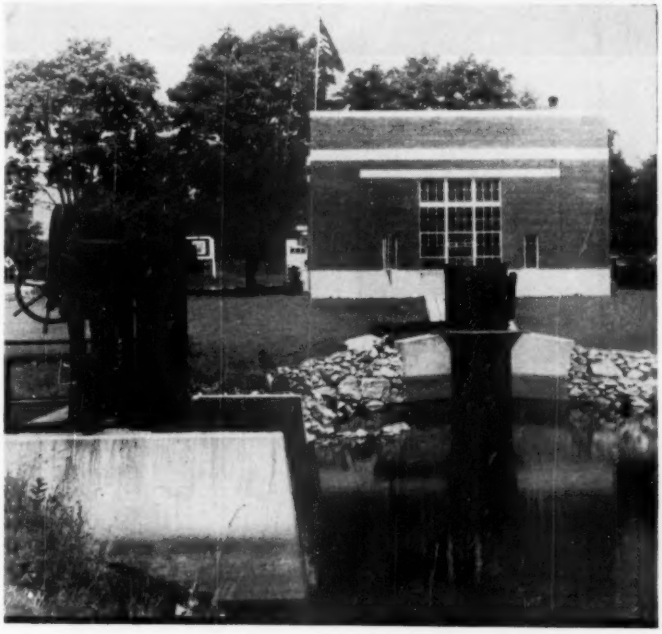
FEBRUARY 1950 VOLUME 81 • NO. 2

PROBLEMS OF SMALL SURFACE WATER SUPPLIES

W. W. TOWNE

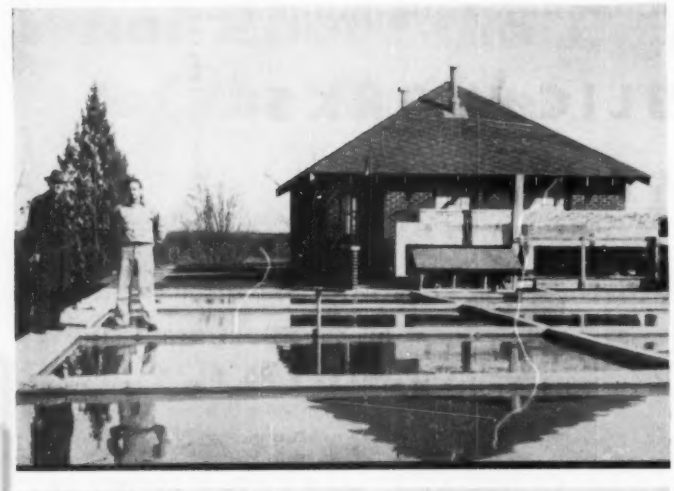
Mr. Towne, who was formerly director of the Division of Sanitary Engineering of the South Dakota State Department of Health is now in charge of the Ohio River Basin for the U. S. Public Health Service.

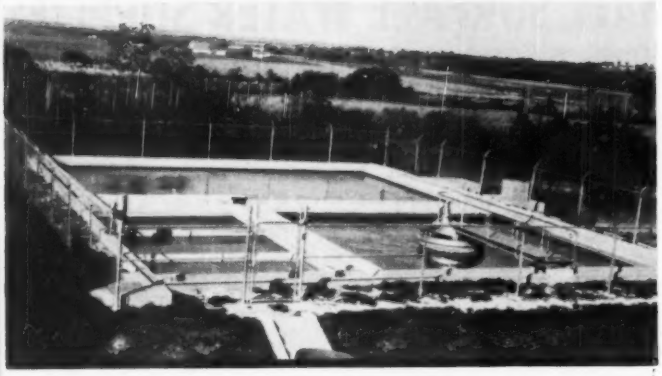
SOUTH DAKOTA is not blessed with a bountiful supply of either ground or natural surface waters for desirable domestic water supply developments. Although the state is underlain with one of the great artesian aquifers, the Dakota Sandstone, this water is highly mineralized and throughout much of the state it is many hundred feet below the surface, particularly in the area west of the Missouri River. Consequently, the cost of development is extremely high, the life of the average well casing is relatively short, and the water carries many objectionable minerals in solution. Due to the high hardness content, half or more of which may be noncarbonate hardness, softening is not only expensive but also leaves objectionable minerals in the treated water. These same areas are lacking in streams having sustained flows or the communities are not located adjacent to those few which could dependably supply a minimum quantity of water for domestic use. As a result of these conditions, many towns in the "West River" area have not developed municipal water supply systems or have experienced failure and dissatisfaction with existing well water sources.



Problems of Water Supply

The lack of sufficient surface water has long been recognized and several years ago the State Game and Fish Department started a program of creating artificial lakes by impounding flood run-off from suitable





● ***THREE views of water treatment installations for small communities. Top to bottom, Kansas and New York.***

catchment areas. During the depression of the thirties, considerable impetus was given to this program when many dams were constructed as Public Works projects. Today there are approximately 500 to 600 such artificial lakes scattered over the entire state, ranging in capacity from 500 acre feet to several times that amount. Although these are constructed primarily for recreational and fish and wild life purposes, in many instances they have provided an adequate quantity of surface water for small community water supply. In almost every instance, the mineral content of such waters is far less than that of available ground waters. Chemical analysis of several lake waters show total solids content in the neighborhood of 200 to 700 ppm with hardness ranging from 50 to 350 ppm. Furthermore, most of this hardness is in the carbonate form, so that softening is economical, if required at all. It is impossible to control the water sheds of such lakes and it is also necessary to permit the lakes to be used for boating, fishing and bathing. As a result, treatment plants must have facilities to insure adequate purification at all times. The pollutional loads entering these lakes are rather light as, for the most part, the watersheds consist of sparsely settled range or agricultural land. Coagulation, sedimentation, rapid sand filtration, and chlorination supply adequate treatment from a bacterial standpoint.

During recent years four small South Dakota municipalities have constructed water treatment works; namely, Murdo, Wall, Faith, and Philip, having populations (1940 census) of 680, 500, 522, and 833 respectively. These plants utilize artificial impoundments as the source of supply. In all instances these plants have rated capacities of approximately 100 gpm.

The design requirements established by the State Department of Health are essentially as follows for the conventional coagulation, sedimentation, and filtration-type of plant:

Raw-water Intakes—The raw water intakes, which are simple structures located in the deeper portions of the lakes, take their supplies from only one level, usually four or five feet off the bottom. It is believed that little benefit would be derived in these rather shallow lakes by having different level draw-offs; at least the benefits would not appear to warrant the costly structures required to accomplish this.

Chemical Mixing — Mechanical mixer with mixing period of approximately 30 minutes.

Sedimentation—Plain sedimentation basins having a detention of 6 hours.

Filtration — Gravity-type rapid sand filters rated at 2 gallons per square foot per minute.

Back wash rates—Minimum of 24 inches per minute.

Chlorination—Both solution feed gas and hypo-chlorinators are used.

Chemical Feeders — These vary with the needs; however, in the most recently designed plants, solution feed machines have been used.

Special Features of the Plants

Realizing that all unnecessary expenditures must be avoided, especially at present construction costs, every effort is made to include in the plant design only the minimum essentials.

All plants have two filter units, but they discharge to the clear well through a single rate-of-flow controller. Thus, they are operated as one unit. Three of the plants use the tub-type filters; for such small units these are more economical than reinforced concrete filter cells.

Simple mechanical chemical mixers are used as they require less maintenance than baffle mixers, provide more positive mixing, and are more economical to construct. One plant, designed for softening, uses an up-flow type basin but the overflow rate is but one-half that approved for larger installations. The other plants use plain sedimentation basins with gravity draw-offs for sludge. Due to low turbidities, cleaning operations do not impose a serious problem.

Two plants obtain their back-wash water from the distribution system, the plants being located close to the elevated storage. The others use separate back-wash pumps, taking suction from the clear well. Inasmuch as the two filters operate as one during filtration, it is of course necessary to back wash both units before either is placed in operation in order to maintain the same head loss through each filter.

Two plants are equipped with constant head orifice inlet boxes on the raw water inlet piping. This feature simplifies operation in that the flow is constant through all units.

Operational Problems

Each plant is operated by a single operator and the period of plant operation ranges from 3 or less hours per day during winter months to as much as 10 to 12 hours per day in the periods of high summer water consumption. Some days the plants may not need to be operated at all. This intermittent operation provides a long period of quiescent settling. In fact, the average operating period approximates the theoretical detention period in the settling tank. This results in a very well clarified water going onto the filters when operations are resumed the following day.

The artificial lakes are reasonably free from turbidity and relatively shallow. Maximum depths are in the neighborhood of thirty feet with considerable areas but a few feet in depth. After a few years these shallow areas become heavily seeded with aquatic vegetation. These factors, together with the high summer temperatures, favor prolific plankton growths which have resulted in taste and odor problems of considerable magnitude. Taste and odor removal as a part of plant operation is usually a difficult problem at best, requiring technical knowledge and training not usually possessed by the local operator. Although facilities for feeding activated carbon and for breakpoint chlorination are available at some of the plants, the best control has resulted from copper sulphate treatment of the lakes. Through careful and intelligent observation of past experiences and with some technical assistance from the Division of Sanitary Engineering, the operators have been quite successful in controlling taste-producing plankton life without excessive use of copper sulphate.

Qualifications for Operators

The design and construction of water purification works for small communities is only one phase of furnishing that community with a potable water supply. Another equally important phase is supplying competent plant operation and maintenance. This is especially true where the design is limited to the essentials only and does not include some of the desirable refinements and standby units. Furthermore, there is a limit to what the community can pay. As previously stated, operation is usually limited to one man with some possible assistance for emergencies. It is quite evident, therefore, that the person employed has had no previous training in the field and must start from scratch. Under these circumstances, it would appear that such an operator should have the following qualifications:

1. **An inquiring and analytical mind.** With such a makeup, the operator will become interested and even fascinated with his work and will, by self study and some technical help, acquire considerable knowledge of the science of water purification. He will also ask himself why things happen as they do and will look for the answer.

2. **A knowledge of machinery, motors, etc., and better than average mechanical skill.** This is particularly essential, as excellent maintenance is essential for continuous operation, and in case of a breakdown the operator may have to make his own repairs. Large machine shops with skillful mechanics are not usually located in these small communities.

3. **Dependability and integrity.** Upon this man's shoulders rests the health of the whole community. He must be capable of carrying out that responsibility.

It has been the experience of this Department that a man having the above qualifications will develop into a very efficient and capable water plant operator.

The Division of Sanitary Engineering spends considerable time with new operators, usually several days at the time the plant is placed in operation. Frequent subsequent inspections are made routinely, especially during periods of changing water quality. Also, the facilities and personnel of the Division are available upon call by the plant operators.

An interesting side-light is that one of the new plants, completed in 1948, was financed by revenue bonds which will be paid off largely from revenues from a municipally owned liquor store.

● ***SMALL plant provides safe water for northwestern community.***

HOW A ONE-WAY GRID SYSTEM

R. F. KAROLEVITZ

LAST winter the city of Eugene, Oregon, faced a decision. Its heavy traffic volume and narrow streets, plus the influx of new citizens, created a street congestion problem which was acutely serious.

A joint commission of the retail merchants committee of the Chamber of Commerce, the public works committee of the city council and the city planning engineer, Howard Buford, faced these choices: 1) Widen the streets; 2) remove all parking from the business area; or 3) develop a one-way grid system.

Widening the streets would have been a million-dollar undertaking as it would have necessitated arcading many business buildings to allow sidewalk space for the increased pedestrian traffic. Eugene now has 400-foot blocks measured from the center of the intersections; and 14-foot alleys cut each block both ways. Willamette, the city's main street, had been widened previously but was narrowed again to 42 feet when narrower sidewalks could not handle the pedestrian traffic.

The second choice would have endangered out-of-city and suburban business. As it was, Eugene faced the additional problem of seeing its business district decentralized to the city's outskirts as the difficulties of downtown shopping drove people elsewhere. Like many other cities, on the west coast particularly, Eugene has watched her population double from 20,000 in 1940, while 35,000 more people have entered the central Willamette Valley farm and lumber region for which Eugene serves as a wholesale distribution point.

What the One-Way Grid Has Done

The third alternative seemed most reasonable, so on Dec. 6, 1948, a one-way grid system was inaugurated in the 40 square block business area.

After a year's use, the system has: 1) Doubled the traffic capacity of downtown streets; 2) halved the time it takes to get across town; 3) increased opportunities to park; 4) decreased accident rates; 5) slowed decentralization of the business district; and 6) set a pattern many cities larger and smaller are eyeing.

● *TWO LANES of one-way traffic and two parking lanes are shown on Eugene's Main St. The one-way system has doubled traffic flow capacity and solved many traffic headaches.*

The Eugene plan was originally suggested by F. B. Crandall of the Oregon State Highway department. Mr. Buford, Police Chief Keith L. Jones and Lt. Delmar Cash, head of the police department traffic safety division, planned the grid, tying it in with the two one-way streets which had previously been assigned to carry Highway 99 traffic through the city.

It cost Eugene $1,500 for one-way signs and traffic dividers. Meanwhile, an educational program was carried on through the local newspaper so that Eugene drivers would be prepared for the new system. The Eugene planners recommend this particularly. They also recommend elasticity in original plans. Mr. Buford advises: "Make your initial plans flexible. If you spot a defect, admit it's a defect and seek an answer."

What Questionnaires Showed

The first weakness in the Eugene system came from the businessmen on the east side of town. Their business was being crippled because it required as much as a four-block drive for customers to go from one street to the next parallel one. A street was dropped from the grid and the problem was solved.

That's when the experimenters decided that it would be wise to learn the attitudes of the citizenry on the matter.

After four months trial of the new system, 5,000 postal card questionnaires were prepared and placed on the windshields of cars parked in the grid area. Thirty-six percent of these ballots were returned. The results showed:

Favor one-way system as it is	**77.0%**
Modify the one-way system	**8.2%**
Return to a two-way system	**14.8%**

Some businessmen argued that the poll reached only those people who came to town; probably there were many who stayed away because they did not like the system. Mr. Buford urges other cities to consider this when trying similar polls.

Then a questionnaire was prepared to get the reactions of local business and professional men — men who were directly affected by the system. Of all ballots mailed 26% were returned, with the one-way system favored 5 to 1. The opposition generally favored revision

SOLVED TRAFFIC PROBLEMS

● ***TERMINALS of one-way streets should be extended beyond congested areas. The above exit of an important one-way street has since been moved one block farther out.***

streets have high crowns (or deep gutters to carry off Oregon rains). Since most cars are built for normal right-hand parking, a condition arises with left-hand parking on warm days. When cars tip to the left with gas tanks nearly full, the gas runs into the intake tube closing off the air vents. Pressure built up in the tank by the temperature forces gas out the air vents and into the street. With a gutter full of gas, a cigarette butt can be a dangerous thing. Consequently, Eugene firemen have been busy on warmer days flushing down streets.

But all told the Oregon city has been happy with the successes of its grid system. Buses make it across town in 4 minutes instead of 10; delivery trucks make routes in an hour's less time; traffic lights send cars in easy streams instead of acting as control spots—a survey shows that 11 to 12 cars now pass through each signal where only three were able to make it each way before

of the one-way grid but not a return to the two-way situation. Business and professional offices were overwhelmingly favorable to the one-way system.

The polls proved valuable to the planners as they learned where they stood and at the same time picked up helpful suggestions.

Pointers for Others

Here are pointers the Eugene experimenters offer to those who are considering one-way grids:

1) Always run one-way streets in pairs; if two streets run south, two should run north to keep the traffic flow even.

2) Carry one-way streets beyond traffic centers to eliminate congestion.

3) Carry on an educational campaign for local drivers so they use the one-way streets properly.

4) Make your plan flexible.

5) Place warning signs on the highways approaching the city to notify "strange" drivers to be on the lookout for the one-way grid. It is dangerous to be caught wrong-way in a one-way street, and it's also embarrassing. There are several cases on record of salespeople and tourists who changed their minds about staying overnight in Eugene after experiencing such a situation.

The firefighting system must be considered when developing a grid. With two-way systems red lights can be turned on and firetrucks can maneuver through halted traffic at intersections. However, with a one-way system, a "build up" occurs at a red light in both lanes and completely blocks the trucks. At present Eugene is giving green lights to the trucks in the direction they are heading.

Another problem is attributed to left-hand parking. Some of Eugene's

because of the difficulties of turning at intersections.

Added to that R. H. Baldock, Oregon State Highway engineer, estimates that accidents in the grid zone are a third to a half less because the points of conflict are reduced from a possible 28 to 6 at each intersection.

Each week the Eugene planners receive letters or visits from other city officials who are anxious to solve traffic problems of their own. Mr. Buford and his cohorts are happy to share their grid system findings with any city seeking a cure for "traffic headaches."

One-Way Grid System Questionnaire

To: All Business and Professional men within the City of Eugene and to Property Owners within the present Grid System.

1. What percentage change in business volume have you experienced during the first six months of 1949 as compared to the first six months of 1948? _____

2. Is the percentage change in your business volume during the first six months of 1949 as compared with the first six months of 1948, different than the national percentage of change in your line of business? _____

How much? _____

● ***PORTION of ballot sent to business men and property owners.***

● *SECTION of line ready for backfilling. Sheeting was not needed on this section, but was used on most of the work.*

small pipe was of reinforced concrete. The 10-ft. outlet pipe, with a shell thickness of 10, ins. was cast in 6 ft. lengths. Each section weighs about 14 tons. Reinforcement depended on the depth of cover.

Because the construction of the sewer was through busy streets, a number of precautions were taken to avoid undue interference with the use of the streets. To reduce the width of the trench, steel piling was used. Steel H beams, driven at 8-ft. intervals ahead of the trench opening, provided support for the walers, behind which tight steel sheeting was driven. This sheeting was placed as the excavation progressed.

To reduce to the minimum the time that each street was closed, the following procedures were used: The clay soil excavated from the trench was hauled away and wasted,

BUILDING A TEN-FOOT DRAIN OF PREFABRICATED PIPE

W. R. DRURY

Drury, McNamee and Porter, Consulting Engineers

(Photos by Sam Buderman)

THE rapid growth of Midland, Mich., necessitated provision for storm drainage for an area of about 5.5 square miles lying partly within and partly without the present corporate limits of the city. The natural outlet for this area is through an open creek about 3 miles long, which passes through a fine residential and golf course area. To enclose and enlarge this creek for its entire distance would have required more than the funds available; and its existing capacity was inadequate to carry the expected storm flow.

It was therefore determined to construct a direct outlet about one mile long through the center of the city. Plans were prepared on the basis of tunneling and of open cut, using precast concrete pipe, and bids were received on both projects. The lowest bid on a 10-ft. diameter sewer, using tunnel construction, was $218.00 per lineal foot. The low bid on open cut construction, using the precast pipe, was $147.00 per foot, plus necessary pavement replacement at $1.75 per sq. yd., where this was necessary. The contract was awarded on this basis.

The Storm Drainage System

The storm drainage system includes 6.7 miles of pipe, from 10-inch to 10-ft. in size. All but the

eliminating the usual spoil banks along the streets. The pipe was then laid, keeping open as short a section of the trench as was possible; and the sewer trench was backfilled with a sandy soil which was hauled in. This was compacted as it was placed, so that the pavement could be laid promptly. In this manner it was possible to confine operation mainly to a single block, and to keep inconvenience to property owners to the minimum.

It was necessary to cross under two railroads. The tracks were supported on trestles while the sewer was being built underneath. For such under-track sections, pipe used was heavily reinforced, but otherwise was of the same section as was used elsewhere.

● ***CRANE** takes pipe from trailer at job site and places it in proper position in the trench. Lifting hole and support, shown at left below, facilitated handling pipe.*

Molds, forms, cores and pipe making equipment were specially manufactured for this job by Federal Steel Fabricators. A stationary concrete mixer was used, so set up that it discharged into trucks which backed into a pit below the discharge spout. The trucks handled the concrete in an elevated box of special construction, equipped with hoists so that the concrete could be poured directly into the pipe forms.

The cured pipe was loaded by a crane onto a flat-bed trailer which hauled single lengths of the pipe. At the job, another crane unloaded the pipe and placed it in proper position in the trench. Pipe handling was facilitated by a lifting hole in the pipe and a curved support which fitted the interior of the pipe and distributed the stress due to lifting. The pipe was furnished by the Universal Concrete Pipe Co. and the Lock Joint Pipe Co. L. W. Wells Construction Co., Saginaw, Mich., is doing the work which is expected to be completed early this year. Total cost of the project will be covered by a bond issue of $1,600,000 which was authorized by the City of Midland in 1947.

● ***LOWERING** pipe section onto low-bed trailer.*

● ***MAKING** the pipe; finished sections at left.*

● ***CHARGING** aggregate into the concrete mixer.*

● ***TRUCK** for handling the concrete into forms.*

● ***PEAK-HOUR traffic, a determining factor in design, has a fairly constant relation to annual average daily traffic.***

How to relate TRAFFIC

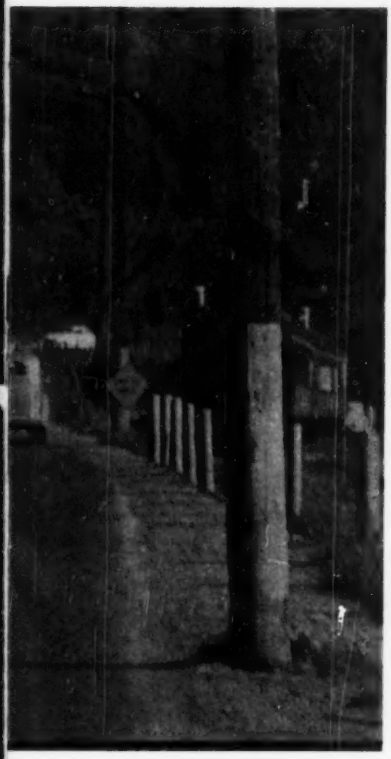
HIGHWAY capacities have been considered in an outstanding manner by a Committee of the Highway Research Board and have been reported in *Public Roads*. A discussion of the general factors affecting highway capacities was abstracted in PUBLIC WORKS for December, 1949. This article is a condensation of Part VIII of the Committee report, covering relations of hourly and annual traffic volumes. This was prepared by O. K. Normann and W. P. Walker. Other portions of this section of the report cover signalized intersections; weaving sections and unsignalized cross movements; and ramps and their terminals.

Traffic volumes are often or usually expressed in terms of vehicles per hour. However, in the solution of traffic problems, the engineer often finds that complete and detailed hourly data are not available. Sometimes the only traffic information at hand is the annual average 24-hour volume, based either on a few counts made throughout the year or estimated from counts made at nearby locations; or perhaps counts for a single day, for several scattered days, or even a part of a day, may be all that is available. Though the cost of obtaining comprehensive information is small, it may be considered necessary to use the scant information at hand. In such cases, the data available may be converted to the equivalent annual average daily traffic volume. Though this will, in many cases, be necessarily approximate, it is in a form most readily adaptable to design.

Annual Average Volume vs Capacity

Annual average daily traffic volume is not a direct measure of the number of needed traffic lanes or other "geometric" features of the highway necessary to serve traffic. Studies show that, at most locations, the annual average daily volume of traffic is exceeded during about 160 days of the year, though much naturally depends on local conditions. In some locations the annual average will be exceeded during a greater number of days, while in other locations it will be exceeded during fewer than 160 days. In any case, a design that is based on the annual average daily traffic load will be overtaxed for a considerable portion of the year. In fact, on the average rural road, the volume on some days will be more than twice the average. This is not likely to be the case so frequently on urban streets for reasons that will be discussed later.

While consideration must be given in design to the brief but frequently repeated rush-hour periods, it is not necessary to provide for the extreme hourly volumes of traffic that may occur but a few times during a year. It is desirable to select, for design, a specific period of one hour during which hour the volume of traffic represents a reasonable basis for planning the highway facilities. To the traffic during this selected hour should be added an estimated



VOLUMES

TO PEAK FLOWS

percentage to provide for future increases.

Hourly traffic counts for a complete year, when arranged in hours of descending traffic magnitude, simplify the problem of selecting the proper hourly capacity for design. The study of many records of traffic has shown that a close and relatively constant relationship exists between the peak hourly volume and the annual average daily volume. Also hourly volumes increase in about the same ratio as do average daily volumes, so that design for future traffic is simplified.

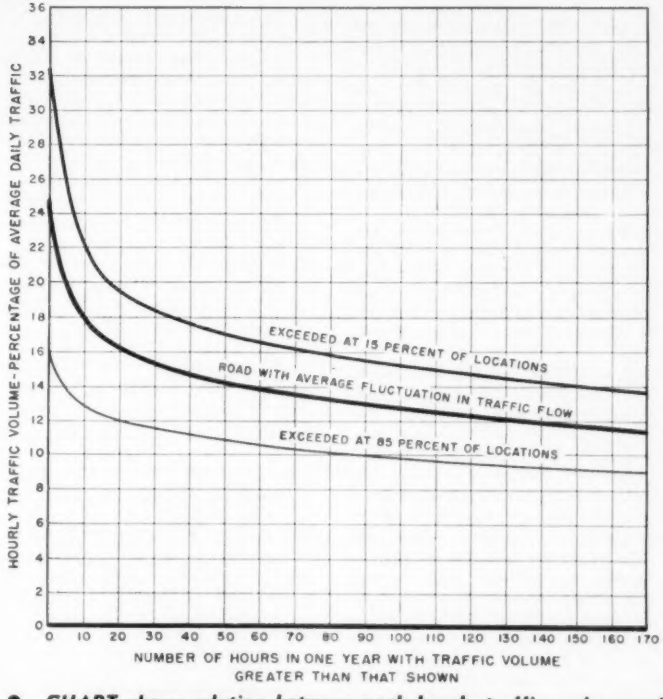
The Bases of Design

At about 70% of the locations that have been studied, the peak hourly volume is approximately 25% of the annual average daily volume. However, at 15% of the locations studied, the peak hourly volume exceeded 32% of the average daily volume; and in another 15% of the locations, it was less than 16%. The relation between peak hourly flows and annual average daily traffic on rural roads is shown in the accompanying graph.

If the data from which the graph was prepared were arranged to show the percentage of the total vehicles using the road when each of the hourly volumes shown were exceeded, it would be found that this number was small for the periods of peak hourly flows. For example, a design based on the 10th highest hour might provide ample facilities for all but 1% of the total number of vehicles using the road. Therefore, this graph is a good guide for selecting a reasonable hourly volume for the design of a highway. It will be noted that the peak hour of the year would, for the average fluctuation in traffic flow, require a roadway capacity equal to 25% of the annual average daily volume. If the annual average daily volume to be provided for is 4,200 vehicles, design would have to provide for 1,050 vehicles per hour. On the other hand, if design were intended to accommodate traffic for all but the highest 130 hours of the year, it would be necessary to provide for only 12% of 4,200 or about 500 vehicles per hour.

During these highest 130 hours of the year, a considerable number of drivers would be inconvenienced, perhaps as many as 8% or 10% of those using the road. Therefore, design based on 500 vehicles per hour is undesirable. As a matter of fact, examination of the graph shows that there is a critical point on the curve where the maximum number of vehicles is accommodated with what might be termed minimum design. This is about the 30th hour. Using this as a basis, and assuming the data above, design would provide for about 15.3% of 4,200 or about 640 vehicles per hour.

Providing for an hourly traffic that is exceeded more often than 30 times a year produces small returns in terms of driver benefits, since it will affect a small percentage of all those using the road. On the other hand, little will be saved in construction cost and a great deal will be lost in



● ***CHART shows relation between peak hourly traffic and annual average daily traffic on rural highways.***

driver benefit if provision is not made for at least the 50th highest hourly traffic volume. Between these two limits design can usually be justified, though there may be numerous specific locations where local conditions may make some other design basis better. It is never possible to apply nation-wide averages to all conditions without allowance for local variations.

The 30th Highest Hour and the Annual Average

Since construction costs to provide for the 30th highest hourly volume are not much greater, in most instances, than to provide for the 50th highest hour, it will be assumed here that the 30th highest hour will be used for design. Actually, on the basis of 4,200 vehicles per day, 30th hour design would require a road capable of handling 642 vehicles per hour, while 50th hour design would require a road capable of handling about 600 vehicles per hour. These figures are based on the curves shown on the chart on page 43.

The relation between the 30th highest hourly volume and the annual average daily volume at rural locations is quite uniform. Though this relation varies on different roads, the percentage basis on any given road remains remarkably uniform from year to year, despite considerable increases in volume of traffic. That is, the many factors which operate to influence traffic at a particular location do not materially change the 30th highest hour percentage. These facts permit computations of the probable traffic load during the 30th highest hour of a future year with considerable confidence. For instance, if conditions indicate a 20% rise in the annual average may be expected in 10 years, a similar 20% increase may be expected in the 30th highest hour.

However, on a road that is already congested during 30 hours of a year, a 20% gain in annual average daily traffic will increase congestion far more than 20%. By reference to the chart, it will be noted that a 20% increase in annual average traffic will increase the hours of congestion from 30 to about 100. This may be computed as follows: Assume the average daily volume is 4,900 vehicles and the 30th highest hour traffic is 750 vehicles. A 20% increase in average daily volume would mean 5,880 vehicles per day. If the capacity of the road remains the same — 750 vehicles per hour, or, 12.7% of the average daily traffic — this figure will be exceeded during about 100 hours of the year. A correspondingly higher percentage of those using the road will be inconvenienced.

These data may be used in a similar manner to determine the abiltiy of a road to carry the increased traffic expected at some future time. Assume a present annual average daily traffic volume of 3,000 vehicles, which is expected to increase by 15% in eight years, or to 3,450 vehicles per day, based on the annual average. If the 30th highest hour is 15.3% of the annual average, then the capacity required eight years hence will be 528 vehicles per hour. This may be checked against actual capacity, allowance being made for such factors as alinement, grade, lane width, lateral clearances and truck traffic, as discussed in the section of the report abstracted in our December issue.

Peak-Hour Urban Area Traffic

Peak-hour traffic on urban roads or streets is generally a lower percentage of the annual average 24-hour traffic than on a rural highway. There are insufficient data now availab'e to explain fully the difference between the 30th peak hour relationship in urban and rural areas. A reason for this lies in the fact that traffic counts in urban areas have often been made on streets which are severely congested during hundreds of hours of the year. Peak-hour volumes of the nature considered in this article are impossible of attainment because the street is incapable of handling traffic in excess of the load imposed on it almost every day during the hours of heavy travel.

In the case of urban improvements, therefore, design must be based on a study of streets that are capable of absorbing some overload.

Capacities of 2-lane and 3-lane roads are stated in terms of total traffic in both directions. The one-direction capacity is dependent on the number of vehicles coming from the opposite direction; and the hour when the 2-directional movement is at a maximum constitutes the period of greatest congestion. For instance, a frequent condition on a 4-lane rural highway is a peak flow of two-thirds in one direction and one-third in the other. Consequently, with an assumed capacity of 6,000 vehicles per hour for such a 4-lane highway, only 4,500 vehicles would be carried when the capacity in the direction of heavy traffic flow was exhausted.

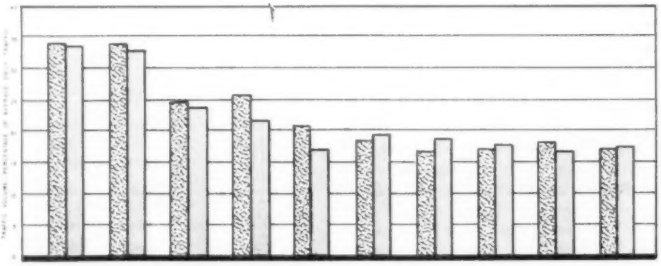
To illustrate the manner in which available data can be employed, assume a future annual average daily traffic volume of 4,000 vehicles, operating on a 2-lane road. Assume further, that the 30th highest hourly traffic is 16.2% of the daily average, or 648 vehicles per hour. If two-thirds of the traffic is flowing in one direction, and one-third in the other, the design one-way traffic will be 432 vehicles per hour.

It is usually sound, in the absence of detailed information as to traffic balances, to assume that two-thirds of the traffic will be in one direction during the design peak hour in rural and outlying urban areas. In cities, distribution of traffic becomes more evenly balanced.

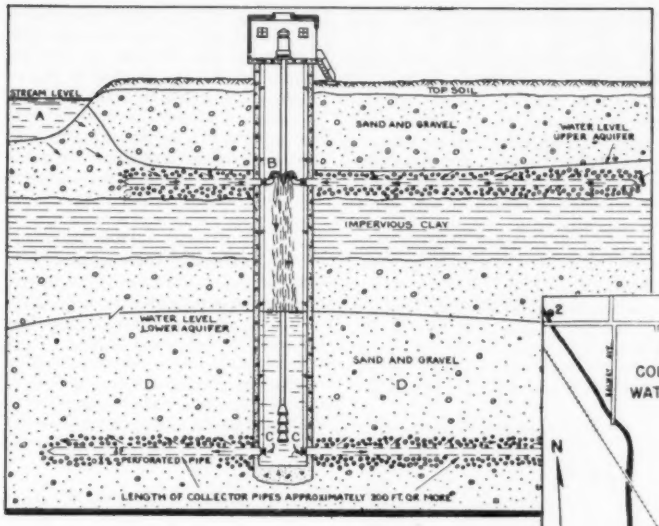
Traffic During Various Periods of the Day

On main rural highways it may be assumed that 74% of the day's traffic occurs between 7 AM and 7 PM. Though the 2 PM to 10 PM and 8 AM to 4 PM periods each accounts for about half of the total day's traffic in rural areas, the 2 PM to 10 PM period is the heaviest in urban areas.

The traffic volume during the 8 hours (not necessarily consecutive) that have the highest total traffic flow is often of value in considering traffic signal installations. About 57% of the daily traffic on main rural highways and 53% on urban roadways occur during the highest 8 hours of the average day.

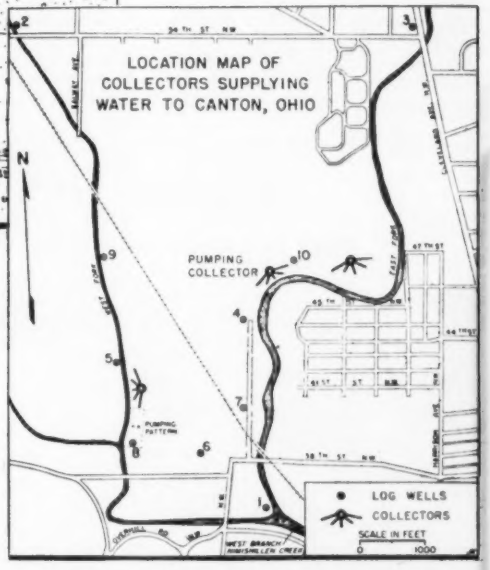


● ***30TH HOUR relations remain constant from year to year.***



● ***WATER from stream A enters the collector B and drops down caisson, and goes through the lower set of laterals C into the lower aquifer D.***

GROUND WATER STORAGE AND RECHARGE



● ***MAP SHOWS area around Canton and location of collectors and preliminary log wells.***

R. G. KAZMANN

NEEDING a new water supply, Canton, Ohio, agreed to finance a hydro-geologic survey to determine the perennial quantity of water that could be obtained from the water-bearing strata in the valley of the West Branch of the Nimishillen Creek, which lies near the city. No stream flow data were available on this creek, but it was felt that the flow could be closely estimated. Studies in Ohio have shown that dry-weather runoff is primarily determined by the surficial geology of the drainage basin. A long record of flow was available for Sandy Creek, the watershed of which was of the same character as the West Branch. Moreover, a number of simultaneous gagings had been made on both streams, which facilitated comparisons of flow and permitted determination of the fact that during 180 days of each year the effective flow in the West Branch could be expected to be less than 10 mgd.

The subsurface exploratory work revealed that there were two water-bearing strata, or aquifers, in the valley, one underlying the other; and that the two were separated by a layer of clay 50 feet below the ground surface and 5 ft. thick. The upper aquifer was fed by the West Branch and by precipitation. The lower aquifer formed a storage basin with apparently limited inflow.

Analysis of Data

A study of the conditions presented by the exploratory work indicated that the upper strata would not yield the required water quantity. The stream flow was very small during the summer months; the aquifer was shallow and lacked storage capacity to carry through the season of low stream flow; rainfall would be insufficient during these same seasons to furnish the necessary water. Neither could the lower aquifer be relied on to furnish the required amount of water. There was plenty of water available in storage, but the recharge appeared to be small. It was estimated that this aquifer would be exhausted by any pumpage in excess of about 3 mgd, while the needs of the city were about three times this amount.

The investigations and the hydrogeologic analyses indicated that a solution could be found in the following program. The construction of a collecting system to produce up to 18 mgd from the upper aquifer dur-

ing periods when the necessary amount of water was available; provision for drawing 10 mgd during dry periods from the storage in the lower aquifer, which was estimated to contain 2,700 million gallons; provision for charging the lower aquifer from the upper one during periods of large flow in the West Branch; and the installation of the necessary pumping equipment.

Accordingly there were constructed three dual-purpose horizontal infiltration collectors with a total maximum infiltration capacity of 18 mgd. One of these collectors was designed to act as the water supply unit and was equipped with three pumps, each of 5 mgd capacity. This was sunk to a depth of 140 ft. The other two units have no pumps and are designed solely to replenish the lower aquifer.

The firm capacity of this installation is estimated at not less than 10 mgd and it may be greater because this estimate neglects the underflow or natural recharge of the lower aquifer. The estimate is also based on maintaining a minimum flow at all times of 4 mgd in the West Branch, and does not allow for rainfall contributions. The maintenance of a specified volume of flow in the West Branch was desired by the city because the stream, lower down, passes through a park area.

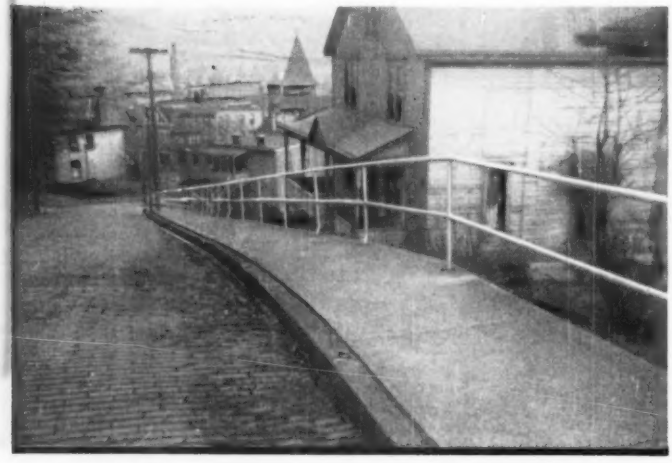
During the course of the exploratory work, several observation wells were sunk into the aquifers. In order to obtain accurate data on the installation so as to be able to determine needs—it was felt that the computations outlined above were quite conservative—a series of weirs with automatic recording gages were installed, and it is intended to measure the observation wells periodically in order to establish and maintain, over a period of years, a running inventory of the water entering and leaving the supply. Studies of the installation are being made by the city of Canton, by the Ohio Water Resources Board, and by the U. S. Geological Survey. Seepage studies (into the infiltration area) already have been made and, during a period of low flow in the West Branch, about 50% of the water flowing could be infiltrated.

Acknowledgements

The data in this article are based on a paper by the author before the Society of Economic Geologists. The project described was executed under the direction of Eugene W. Silitch, president of the Ranney Method Water Supplies, Inc.; construction was under the supervision of A. d'Audiffret, vice-president and chief engineer. Robert E. Reimund supervised the test drilling and the pump testing. A. E. Ransom is superintendent of the Canton Water Department. The writer is associated with the Ranney Method Water Supplies, Inc.

HANDRAILS

Help Pedestrians on Hillside Streets



● ***HANDRAILS are placed on steep streets so that Wilmerding residents can get up and down with safety in snow and ice.***

MATTHEW WOJTON,
Borough Secretary,
Wilmerding, Pa.

Our Borough of Wilmerding lies in a valley, with a majority of the homes built on hillsides, while the business section lies on the floor of the valley. Consequently, there is a continuous flow of pedestrians up and down these steep streets. Some of these steep streets are bad enough on rainy days, but during the winter months when we have snow and ice, it is almost impossible to go up or down them without something to hold on to.

We made a study of the streets and the traffic on them to determine the ones that needed handrails. Then the real work began. Our first job was to get suitable pipe. In this we were helped by the Westinghouse Air Brake Co., our major manufacturing concern. After we got the pipe, our Street Department drilled the necessary holes, cemented the posts in place, welded the pipes together and to the posts, and painted them. The illustrations show some of the handrails installed on our streets.

Insurance Savings Pay for Elevated Water Tank

The manufacturing plant of Barber-Greene Co., Aurora, Ill., covers 25 acres; there are 12 buildings with 310,000 sq. ft. of floor area. By the recent addition of 550 sprinkler heads, 240,000 sq. ft. of the plant are protected by an automatic sprinkler system, the remainder being of fireproof construction.

Though the sprinkler heads are connected to the municipal water supply, pressure in which does not fall below 45 lbs. per sq. in., a 100,000-gal. elevated tank, furnished by Chicago Bridge & Iron Co., was constructed to provide a secondary water supply for the system. The new tank has reduced insurance premiums about 30% and will pay for itself out of such savings in 10 to 12 years.

AUTOMATIC CONTROLS

Assure Proper Waste Treatment

ADEQUATE treatment of waste pickle liquor is a vital factor in steel plants where local laws limit stream pollution. Measurement and control of pH with the Brown-Beckman system described herein accomplishes this treatment automatically, and provides a continuous chart record which proves that the neutralized waste is held within the specified tolerances. This description is from *Instrumentation*, which is published by Minneapolis-Honeywell Regulator Co., Brown Instruments Division.

Basic pH Control System

The components of the control system are arranged as shown in the accompanying schematic drawing. Waste pickle liquor from a storage tank flows through the gate valve *G* (normally open) to the treatment basin. Here the liquor is aerated to oxidize all ferrous iron to the ferric condition while caustic soda is added to neutralize all acids. Vigorous agitation is employed to accelerate the chemical reaction.

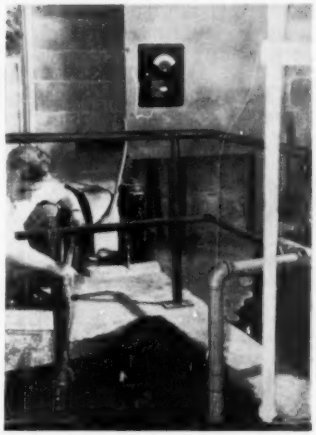
The pH of the neutralized waste is measured by the electrode assembly (*I*) located at the effluent end of the basin. The pH value is recorded by an electronic potentiometer (*pHRC*), which accordingly governs air pressure on the control valve in the caustic soda supply line to maintain the pH of the neutralized liquor at the desired value.

Because neither the pH nor the flow of waste liquor is constant, the controller incorporates proportional plus reset (*Air-o-Line*) control to compensate for these variables. The resulting precise control holds the pH of the treated liquor at the proper value regardless of the normal, unavoidable process fluctuations.

Emergency Limit Control

From the treatment basin, the waste flows to the settling basin, also shown on the drawing. Here the sludge settles out, and is collected and disposed of separately; the clarified and neutralized waste is delivered to the river.

In unusual cases, unspent pickling acid may be dumped into the waste liquor, requiring an abnormal amount of alkali which is beyond the capacity of the caustic soda line to supply quickly. To guard against the release of only partially neutralized waste in such instances, an automatic gate valve is installed in the liquor line from the storage tank.



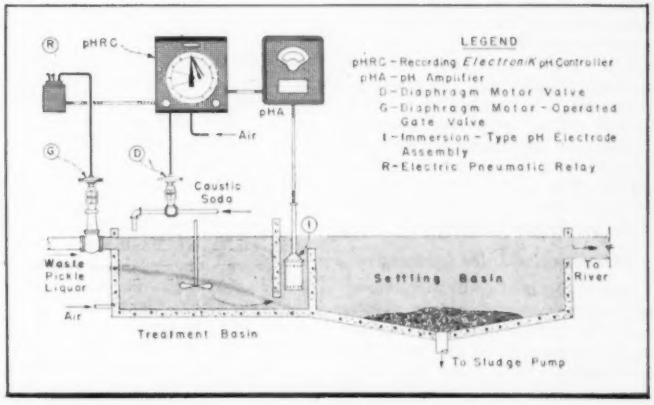
● ***pH AMPLIFIER and immersion electrode at effluent end of treatment basin—"I" below.***

The valve is actuated by a diaphragm motor from air pressure which is controlled by a Honeywell electric-pneumatic relay—the latter being energized by an auxiliary switch in the controller. The relay operates to close the gate valve should the pH of the treated liquor fall below the auxiliary switch setting.

By cutting off flow of waste liquor to the treatment basin, this emergency limit control permits additional caustic to be added to the highly acid waste—*i.e.*, it permits the process to "catch up" with this unusual load change. When the pH of the treated liquor again rises above the auxiliary switch set point, the gate valve on the waste line reopens and normal treatment is resumed.

Advantages of pH Control System

1. Compliance is assured with health and conservation legislation as regards stream pollution.
2. A permanent chart record of the neutralized waste is provided as proof of proper treatment.
3. Excessive waste of caustic soda is prevented by accurate proportioning of the chemical in accordance with the acidity of the waste.

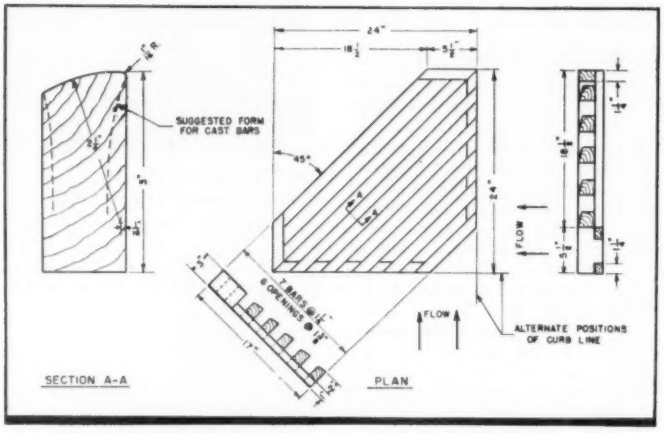


● ***SCHEMATIC diagram of the pH control system for pickle liquor treatment, showing positions of the various units described.***

How to design BETTER INLETS for HIGHWAY DRAINAGE

DATA on the capacity of grate inlets for street and highway drainage, based on comprehensive research by the St. Anthony Falls Hydraulic Laboratory of the University of Minnesota, are contained in Bulletin No. 2 of that Laboratory. The research work was carried out by Curtis L. Larson; Lorenz G. Straub is director. This article is a condensation of the research findings, and is intended to provide highway and drainage engineers with information on how to design better inlets. Descriptive details of the test apparatus and of the tests are omitted.

Inlet capacity is affected by inlet width, length and shape, as well as by the shape of bars and the method of placing them. As a result of the tests, new designs were developed which, though smaller than usual standard inlets, have considerably higher capacity and equally good or better ability to handle leaves or debris. It was also found that the capacity of grate inlets can be greatly increased by permitting a small amount of flow carryover. Capacities of most of the inlets tested were doubled with carryovers of 0.10 to 0.20 cfs. With inlets in series, no undesirable effects are produced since carryover is not cumulative.



● ***GRATE inlet with transverse bars. Rounding the bar surface as shown at left above greatly increased inlet capacity.***

Efficiency of Inlet Openings

Inlet width is of course important, because carryover is almost always partly or wholly composed of flow which passes around the inlet. The tests indicate that inlets should be made at least 24 inches wide for most installations. According to Hicks (Hwy. Res. Bd., Vol. 24, 1944, p. 145), an ideal inlet of this width in a gutter of any cross slope will intercept 85% or more of the flow for a width of flow up to 4.0 ft.

The efficiency of grate inlet openings was found to depend mainly on the effective length of individual openings measured in the direction of flow. A standard 19-inch wide inlet (inlet H), having 1 3/16-inch transverse openings, permitted an appreciable flow to pass directly over the inlet. Orientation of the openings to an angle of 45° with the direction of flow (Inlet A), resulted in some improvement in inlet capacity. With 1¼-inch by 11-inch openings (Inlet G) placed parallel to the flow, no water passed over the inlet, but the narrower width reduced capacity. A 24-inch wide grate (K) developed a much higher capacity. In the inlets with longitudinal bars, a small amount of water passed along the surface of each bar and over the inlet.

Since, with transverse rectangular bars, only a thin sheet of water was diverted downward at the face of each bar, it was determined to round the bar surface to conform approximately to the shape of a free overfall from its leading or upstream edge. Thus, if bar thickness is equal to bar spacing, the effective opening width is doubled and the capacity of an individual opening is quadrupled. The drawing herewith

shows a cross-section of the bar and details of a specially designed inlet (P) which appears to have many advantages. The form of the bar was computed for a gutter velocity of 4 fps and proved satisfactory at all slopes tested. The improvement in the capacity of individual openings is very great. Whereas, six unrounded openings in an inlet (A) (placed at 45°) failed to intercept all of the flow, the first two openings with rounded bars, placed similarly intercepted nearly all the flow, with bars placed normal to the flow, results were not so good, due principally to heavy spray formation with higher velocity indices.

A curb opening adjacent to an inlet provides little or no increase in capacity for efficient inlet openings, unless the inlets are affected by back-water. If favorably located, a curb opening may be of some value in increasing capacity where the velocity is such as to direct spray toward the opening.

High velocities in the approach flow tend to decrease capacity by increasing flow or spray over the openings. On the other hand, a high velocity tends to increase capacity by concentrating a greater flow in a given width of gutter. The width of the inlet, the efficiency of the openings and the velocity index ($\sqrt{s} \div n$) are factors. For low velocity indices, inlet capacity increases with slope; the less efficient inlets reached maximum capacity at a velocity index of about 14; the more efficient inlets increased to 16 or 18.

Tests were also made with paper debris and leaves. All inlets with transverse bars passed only a small percentage of the test debris. With diagonally placed bars, debris performance was only fair with rectangular bars but good when the bars were rounded. The inlets with longitudinal bars were best, though not greatly superior to the special inlet (P).

A grate inlet should have high capacity and self-cleaning ability and be reasonable in cost. Three types were deemed superior. These were: K, a 24-inch wide grate with bars parallel to the flow; N, a grate with diagonal bars; and P, the grate shown in the accompanying illustration. An objection to N is that both left-hand and right-hand designs would be needed, whereas K and P can be installed either way. Grate N is excellent for low slopes and moderate carry-over; K for high slopes; and P appears to be nearly equal to the best under all conditions.

Gutter Capacity and Application

In designing a drainage system, it may be necessary to limit the depth or width of the flow in the gutter. In any case, the depth-discharge relation of the gutter should be known. If the depth is known, the width of flow can be determined. A simplified formula was developed for the test gutter, which had a crown slope of 20.6 to 1 and a curb slope of 0.272 to 1, as follows: $Q = 9.5 \times (\sqrt{s} \div n) \times y^{8/3}$, where y is depth of flow at the curb. The chart herewith shows theoretical depth-discharge relationships for the test gutter for various values of $\sqrt{s}/n$. An empirical formula has been derived, which is $Q = 8.0\ s^{1/2}y^{8/3} \div n$. This gives results which are apparently as much as 10% high in some cases. In these, n is the roughness coefficient.

The present method of computing runoff as a percentage of rainfall can be used as a basis for determining spacing of the inlets. Thus, if the inlets drain only the roadway or other nominally impervious surfaces, the runoff per inlet, QR is: $QR = CbIL \div 43{,}200$, where b is the width of roadway drained; L is the inlet spacing: I is the rainfall intensity in inches per hour; and C is the percentage of rainfall as runoff—normally 0.8 to 0.9.

If QR is to be maximum runoff, I must correspond to time of concentration which, of course, depends on inlet spacing L. Strictly speaking, therefore, the equation for QR should be solved by trial and error, using a rainfall intensity corresponding to the assumed time of concentration followed by calculations for the actual time of concentration. If only paved surfaces are drained, time of concentration will seldom be more than 5 minutes, and this value may usually be assumed.

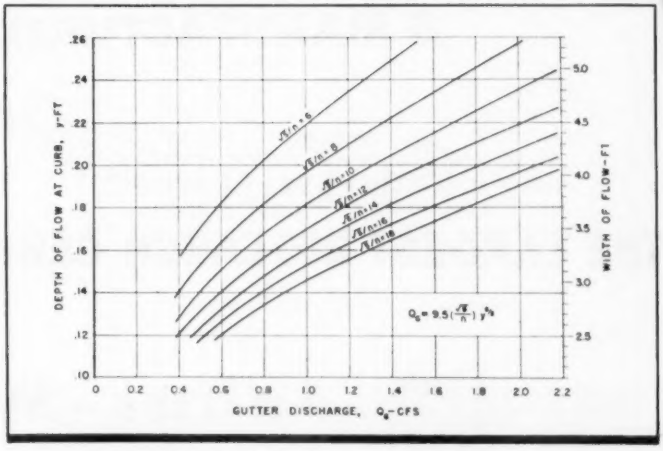
For a series of uniformly spaced inlets, spacing can be determined by a slight modification of the above formula. Assuming a carryover, and a gutter discharge, based on this carryover plus the runoff to the gutter, the spacing of inlets L, will be $L = 43{,}200\ QI \div CbI$, where QI is inlet capacity.

The actual inlet capacity will depend on certain fixed factors, also. In some cases, only a certain width of flow in the gutter is permissible; and this fixes the depth of flow and, of course, the inlet capacity needed.

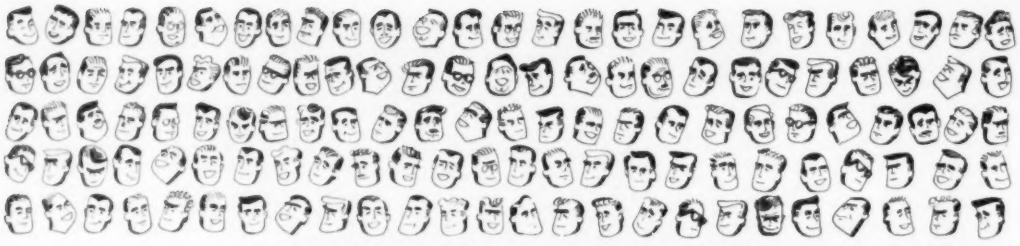
Illustrative Example.—It is desired to drain a 24-ft. width of roadway, having a 5% grade and a gutter roughness of n = 0.015, during a rainfall of 5 ins. per hour with a width of flow in the gutter not to exceed 3.5 ft.

The velocity index $\sqrt{s}/n$ is 14.9. For this gutter, with a width of flow of 3.5 and a velocity index of 14.9, the flow is 1.24 cfs. For inlet P, the inlet capacity with a velocity index of 14.9 is 1.12 cfs. The carryover is then 0.12 cfs. If a value of 0.9 is used for C, the allowable inlet spacing is $L = 43{,}200 \times 1.12 \div 0.09 \times 24 \times 5$, or 448 ft.

A series of grate inlets will adjust automatically to a larger runoff. For instance, if a 6-inch rate of rainfall should occur in the condition above, the inlet capacity will increase to 1.34 cfs and the gutter flow to 1.56 cfs. Carryover is 0.22 cfs. Width of gutter flow increases only to 3.8 ft.

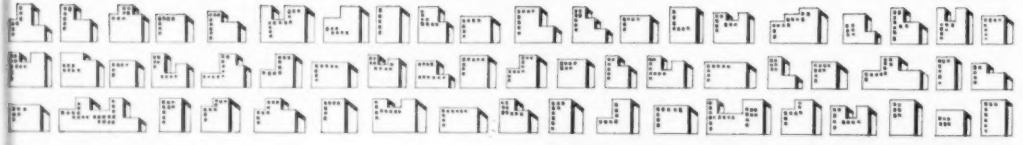


● ***THEORETICAL depth-discharge relationships for test gutter.***

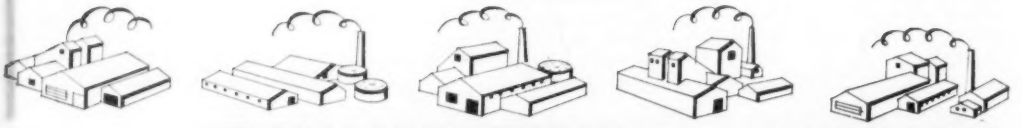


257 FIELD REPRESENTATIVES

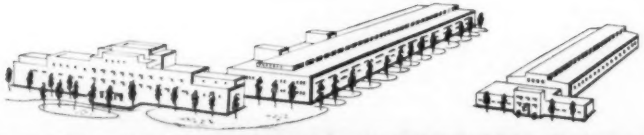
48 INSTALLATION INSTRUCTORS



58 SALES OFFICES



5 MANUFACTURING LOCATIONS



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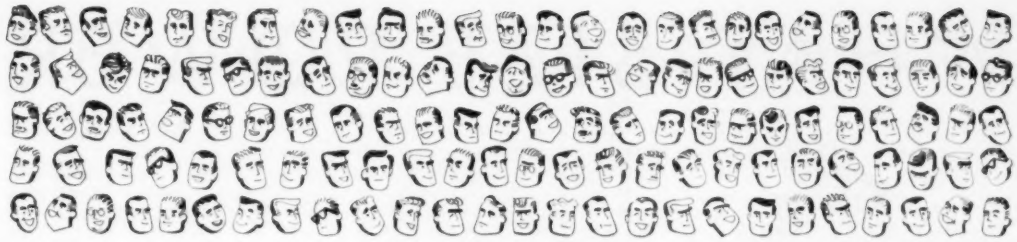

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WHAT SIZE POWER

● *TIME studies help in determining efficiencies.*

CITIES, counties and states use power shovels in construction and maintenance. Generally, these shovels must be used on a wide variety of work, differing in this respect from the shovels used on a large construction job. In the latter case, it is possible to evaluate closely the specific needs and the conditions under which the equipment will work, so that a machine that will be most efficient in performance can be selected. However, there are factors to which consideration should be given when selecting power shovels for city, county and state work. Those relating to the sizes of shovel are discussed in Technical Bulletin No. 3 of the Power Crane & Shovel Association. The data in this article are largely based on that Bulletin.

Considering excavation as a complete movement of material from one place to another, three factors are involved: The size of excavator; the size of the hauling unit; and the management or synchronization of the two. The size of the excavator is affected by the following: 1. Type of material to be excavated; 2, the depth of the bank or cut; 3, the angle of swing necessary for loading; 4, the clearances that are necessary; 5, requirements for moving the excavator from place to place; 6, balancing haul cycles and managing the hauling plant; and 7, the volume of work to be done.

The Type of Material

For digging hard materials, the greater power, larger dipper opening and heavier construction of the larger shovels are advantageous. In easy digging, ready mobility, low first cost, and ability to work in close quarters—attributes of smaller shovels—are equally desirable. How power shovel output is affected by the qualities of the various materials is indicated in Table I. The outputs shown are based on the most favorable depth of cut, a swing of 90°, and grade level loading. Other factors that also influence shovel output are discussed below.

Depth of Bank and Angle of Swing

The optimum depth of bank is that depth of cut which produces the greatest output. Naturally, under such conditions, the dipper comes up with a full load on one pass and without undue crowding. But this optimum depth has no relation to the maximum digging range of the machine.

In very shallow cuts, the difficulty in getting a full dipper in one pass, plus the frequent move-ups that may be necessary, may give the smaller shovels an advantage in cost per yard, and sometimes even a larger output per hour. The optimum depth of cut for a $\frac{3}{8}$-yd. shovel is not less than 3.8 ft. in light, free-flowing materials: 4.5 ft. in common excavation; and 6.0 ft. in hard and sticky clay. For a $\frac{1}{2}$-yd. shovel, comparable figures are 4.6, 5.7 and 7.0 ft.; and for a 1-yd. machine, 6.0, 7.8 and 9.0 ft. Depth greater than the optimum is not a factor in size selection.

The angle of swing is important in operation. A saving of 30° in the swing cycle may increase shovel

● *¾ YARD Link Belt Speeder shovel is used by White Co., Ark., to load rock and gravel for road maintenance.*

SHOVEL *do you need?*

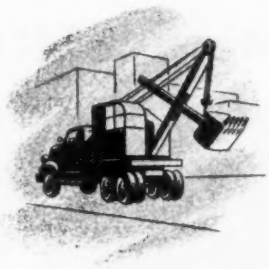
production 15% to 20%. Good planning and work management are important. Where shovel swing is 180°, output may be only 70% to 75% of that possible with a 90° swing.

Shovel Clearance and Movement

Operation in city streets, in alleys, under overhead wires and in trenching, basement or similar excavation may require close clearances. Generally, work under such conditions cannot be carried on with maximum efficiency and it may be advisable to use a smaller power shovel. When considering machines for such work, manufacturer's catalogs should be studied to determine clearances. Some ⅜-yd. machines have rear-end clearances as little as 5½ ft., while on large machines, clearance required may be more than twice as great. The ⅜- and ½-yd. machines have height clearances of about 9½ ft. while in transit.

Except in gravel pit or similar work, city and county power shovels will need mobility to move quickly from one job to another. Rubber-tired units are available in the small sizes, both truck-mounted and self-propelled. If considerable movement is contemplated, clearance and width become important factors. Permits are often required to move units more than 8 ft. wide. The ⅜ and ½-yd. shovels usually do not exceed 8 ft. in width.

Weight is another factor in movement. The ⅜-yd. machines weigh 8½ to 12 tons; the ½-yd., 11½ to 14 tons; and the ¾-yd., 17 to 22 tons. Obviously, the smaller machines are easier, faster and cheaper to move.



● ***MOBILITY is valuable on many kinds of operations.***

Based on 2,000 hours of productive work per year, the useful life of shovels in the ⅜ to ¾-yd. range is about 5 years; for larger shovles, 6 to 8 years. Depreciation therefore, will be about 20% per year on the smaller shovel, and somewhat less on the larger ones. However, in city or county work, it is rather unusual to get 2,000 hours of operation per year. The life may be greater than stated above, but the depreciation cost per hour operated will not be reduced, and may be increased.

In hard, tough clay, with operating delays of 10 minutes per hour, a ⅜-yd. shovel will put out 42 yds. per hour; a ½-yd. shovel 63 cu. yds.; and a 1-yd. shovel 122 cu. yds. These figures do not allow for movement from job to job, weather interference or other not uncommon delays; but they do afford a good basis for beginning to figure costs. In contract work, a definite volume of work is usually available when the shovel is selected. Under such conditions, it is possible to find out what is the most efficient size to be used. In determining this, the type and size of the hauling equipment must be considered.

TABLE I—POWER SHOVEL OUTPUT IN CU. YDS. PER HOUR

Class of Material	*Size of Shovel — Yards*				
	⅜	½	¾	1	1¼
Moist loam	85	115	165	205	250
Light sandy clay	85	115	165	205	250
Sand and gravel	80	110	155	200	230
Common earth	70	95	135	175	210
Hard clay	50	75	110	145	180
Well blasted rock	40	60	95	125	155
Rocky soil	30	50	80	105	130
Sticky clay	25	40	70	95	120
Poorly blasted rock	15	25	50	75	95

Sizing the Hauling Fleet

Modern excavating equipment has a short cycle time, so that loading is expedited. Hauling units should have capacities 4 to 5 times the excavator bucket capacity. Thus, for a ⅜-yd. shovel, minimum haul unit capacity should be 1½ cu. yds. On a 90° swing, the cycle time for such a shovel will be about 19 seconds, and the loading time for 1½-yd. trucks will be 76 seconds. This means that a hauling unit must be spotted every 1.26 minutes, or at the rate of about 48 per hour. Usually, it will be difficult to maintain such a tight schedule, and it will probably be better to use larger haul units, perhaps 2¼ or 3-yd. capacity. This would drop the schedule to about 2 minutes or 30 per hour for the 2¼-yd. unit, and even less for the larger units. Choice between the two would probably depend on the length of haul or the equipment available.

Loading time is the product of the excavator cycle time in minutes and the number of dippers required to fill the haul unit. In this connection, haul units should be equal in size to even units of dipper capacity. Half-dipper loading is not profitable. Further, most excavator dippers are rated in "struck" capacity; in most soils, this is about equal to bank measure or "pay dirt." The heap on the dipper takes care of the swell. Trucks, also, are usually rated on water level capacity, and the heap on the truck again takes care of the swell.

The number of hauling units required is found by dividing the travel cycle time of the hauling units in minutes by the loading time in minutes and adding 1. More hauling units cannot be used to increase excavator output because travel time and loading time fix the number of units. If the resulting hauling capacity is less than excavator capacity, larger hauling units must be supplied. Using more than the number shown by the above formula will cause piling up of trucks at the excavator.

The maximum number of hauling units used times the capacity of each

(*Continued on page* 82)

SMALL SEWAGE TREATMENT PLANT FOR AN AIRPORT

MARION KELEZ

COINCIDENT with the formal dedication and opening of the Seattle-Tacoma International Airport, operation began at the Port of Seattle's sewage treatment plant, which had been under construction simultaneously with the field's modern $4 million central terminal administration building. The Seattle-Tacoma International Airport is owned and operated by the Port of Seattle, and the sewage plant was built to treat all sanitary sewage from the airport. There is a separate storm drainage system.

The plant was designed in the Port of Seattle engineering department under the direction of George T. Treadwell, chief engineer, who also directed the entire airport planning and construction. Design of the sewage plant was assigned to Chester Clausen and Marion Kelez.

Bases of Design

Design basis was a population of 7,000 (1,000 fixed population and 6,000 transient) and a flow of 60,000 gpd. Very conservative factors were employed, however, as the expected population could not be determined accurately at the time of planning. The plant is, in fact, serving a greater fixed population than was expected. A high rate trickling filter was selected because of its flexibility and because it was not thought it would be affected by oils and other wastes which might reach it. Treatment is more complete than is usual in the state of Washington for a plant of this size.

Major plant equipment was manufactured by Lakeside Engineering Corporation, and the installations were furnished by H. D. Fowler Co. under a contract which was awarded to Lease & Leigland, General Contractors of Seattle. Piping and machinery were installed by Navarre Plumbing and Heating Co. of Seattle.

Situated on a 3½-acre tract on the shore of Bow Lake, and just across U. S. Highway #99 from the airport

● ***FENCE and tree screen; other plant units in background.***

proper, plant access is provided by an asphalt surfaced roadway leading from the highway. Because of the location adjacent to the highway, it was necessary that careful consideration be given to the plant appearance and landscaping.

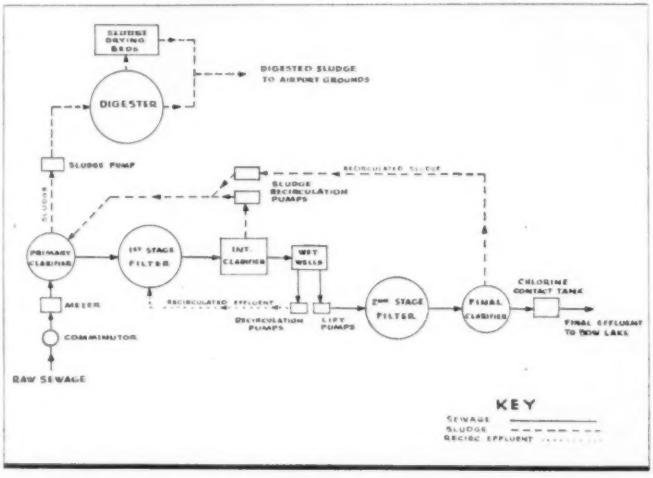
Treatment is through a two-stage filter, flow being by gravity through the first stage filter and intermediate clarifier to the wet wells in the pump room. Sewage reaches the plant through a 12″ sewer tunneled under the highway to a manhole with an overflow by-pass. The influent channel leads through a comminutor, with a by-pass channel equipped with a bar screen. Flow is metered through a Simplex parabolic flume connected hydraulically to a recording flow meter in the control house laboratory.

As the pump room is below grade, there is an 8-inch hydraulically operated overflow prevention valve set in the influent line to the primary clarifier. This valve is controlled by a remote pilot operating at the wet wells in the pump room, and prevents flooding the motors in case of power failure.

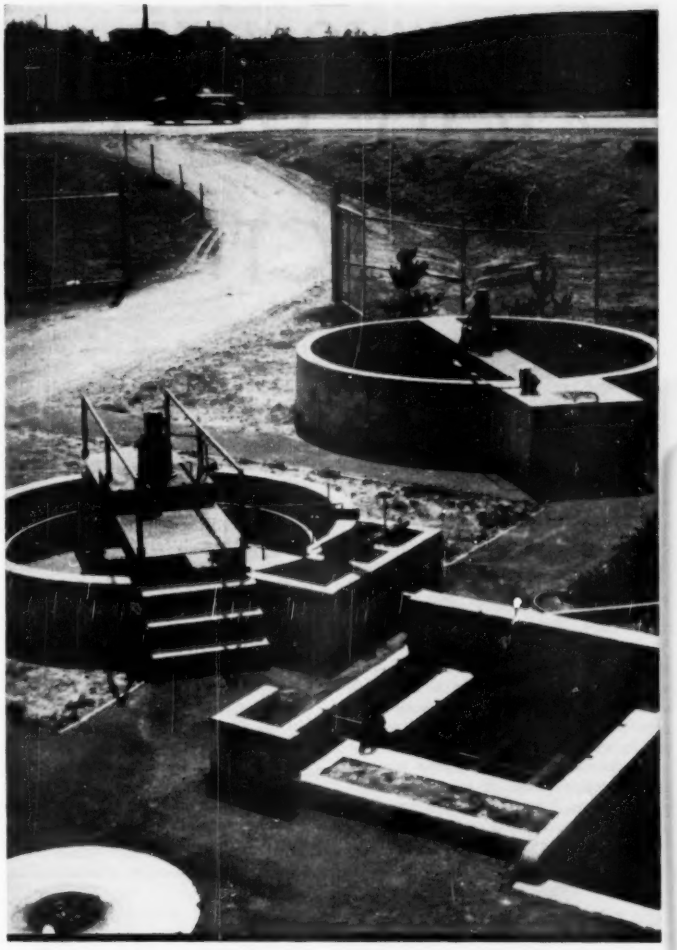
The primary and final clarifiers are 13-foot diameter Spiraflow type, equipped with mechanical sludge scrapers. Primary detention period is approximately two hours.

The effluent flows to the first stage filter, an 18-foot diameter Aerofilter with motorized disc distributor. This operates at an average application rate of under 15 mgad. Filter media is carefully graded rock. Tile underdrains and fan ventilation are provided.

Flow continues from the filter by gravity to a hopper bottomed intermediate clarifier at the control house lower level. This is equipped with baffles and a rotatable scum pipe.



● ***FLOW diagram of Seattle-Tacoma sewage treatment plant, showing plant layout and principal units of the plant.***



● ***CHLORINE contact tank, final clarifier and first stage filter are near plant entrance.***

After sedimentation, the effluent passes over a weir to the wet wells where lift and recirculation pumps are located.

The lift pumps and the recirculation of effluent back to the primary clarifier are controlled by selector type float switches. Wet well level is controlled by a float valve regulating gravity flow of recirculated effluent from the final clarifier to the well. Sewage is pumped from the wet well to the second stage filter by two lift pumps, and flow continues to the final clarifier. These two units are duplicates of the first stage filter and primary clarifier respectively.

Chlorine is applied at a chlorine control tank, providing a 20-minute contact period, by a solution feed metering chlorinator, housed in a room with outside entrance only for safety control. A gas-tight window provides observation for the operator from the laboratory. Arrangements are provided so that prechlorination may be used if necessary.

The chlorinated effluent is discharged into Bow Lake.

Sludge Digestion and Disposal

Sludge is pumped to the digester from the primary clarifier. Two sludge recirculation pumps, set on an automatic timer, pick up sludge from the intermediate and final clarifiers and return it to the primary.

The digester is a domed concrete tank of 11,500 cu. ft. capacity. The sludge inlet is provided with a tangential jet to increase circulation, and an alternate sludge inlet is provided in the tank overhead. Recirculation of the digester content is effected back through the sludge pump, and supernatant is returned by overflow drain to the primary clarifier. The unheated tank is equipped with a waste gas burner.

Sludge flows from the digester to the open sludge beds which are of 3,000 sq. ft. capacity, which will be used during drier season. Liquid sludge may be removed from a hose bib on the digester outlet for distribution by tank truck. It is expected that the entire sludge production can be applied to the airfield and grounds and to other Port property as a fertilizer.

All plant structures are reinforced concrete. Piping is cast iron, wrought iron and concrete. The site is landscaped and surrounded by a woven wire fence with a screen planting of pine. The low architectural lines and mellow face brick of the control house make this one of the most sightly treatment plant installations in the West.

As the plant has been in operation only three months, there are little conclusive operational data available. The average daily flow over the 90-day period was 50,512 gpd. Completion of additional hangars at the airport will increase future flows.

Results of tests show the 5-day BOD of raw sewage ranging from 312 to 840 ppm, with plant reductions of from 92 to 97 percent. The required reduction for the plant was set at 90 percent. Reduction of suspended solids averages 95 percent and of settleable solids 99 percent.

The greatest operational difficulties encountered to date have been caused by the infiltration of oil and wash wastes from hangars and restaurants. Plane washing wastes are at present handled by separate treatment.

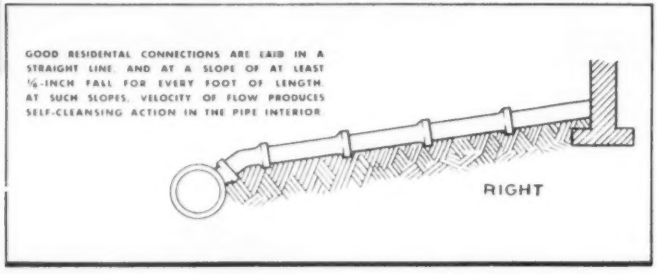
● ***FIRST and second stage filters; Bow Lake in background.***

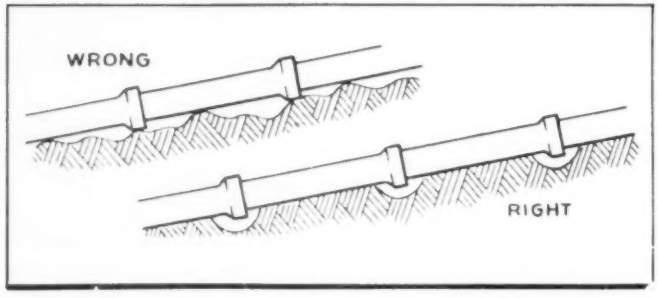
HOW TO MAKE GOOD HOUSE CONNECTIONS

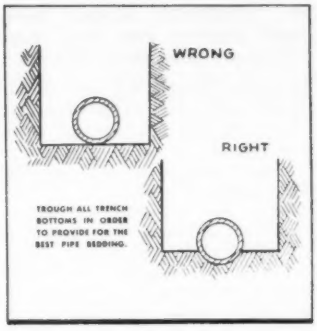
Between each building and the public sewer is an important link—the house connection. In a sense, the house connection is a part of both the house plumbing system and of the public sewer system. More often than not, it has a relatively small inside diameter. Its installation is seldom regulated by rigid construction specifications. Yet anything that interrupts the service of the house connection affects sewer service vitally. A stoppage will put out of service the entire plumbing system of the building, and the system will remain out of operation until satisfactory flow through the connection is restored.

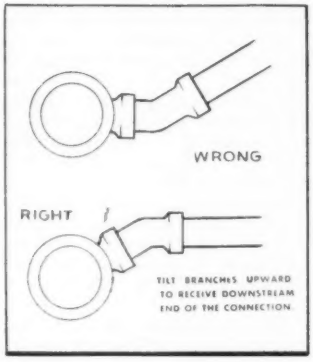
If, for any reason, the house connection is damaged, reconstruction is immediately necessary. Such reconstruction often involves expensive replacement of sidewalks and pavements, lawns and plantings. The best way to avoid this is to provide initially a connection of adequate inside diameter, laid on a straight line and at a sufficient slope to prevent accumulation of solids and clogging. Unnecessary oversize may be as harmful as improper alinement and slope. For residential use, 4-inch inside diameter connections will give fully satisfactory service when laid in a straight line and with a uniform slope of at least one-fourth inch fall for each foot of length. At such slopes, the velocity of flow is sufficient to produce self-cleansing of the pipe interior.

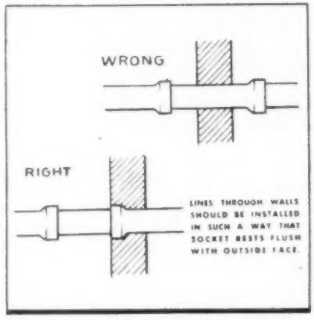
It costs no more to install a house connection properly than to install it improperly. Trenches must be dug in either case, and the exercise of ordinary care to prepare the trench bottom so that the pipe runs straight and on a uniform slope from the foundation wall to the sewer is no more than ordinary conformity with good practice. There is no extra cost for careful workmanship, but the cost of carelessness is high.


GOOD RESIDENTAL CONNECTIONS ARE LAID IN A STRAIGHT LINE AND AT A SLOPE OF AT LEAST ¼-INCH FALL FOR EVERY FOOT OF LENGTH. AT SUCH SLOPES, VELOCITY OF FLOW PRODUCES SELF-CLEANSING ACTION IN THE PIPE INTERIOR.
RIGHT









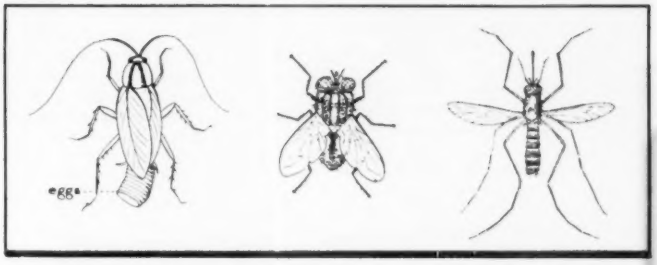
Herewith are shown "right" and "wrong" methods of installing house connections. These illustrations appeared in *Clay*, which is a house organ of the Clay Sewer Pipe Association, Inc., Columbus, O., and are reproduced here with the permission of that association.

● ***THIS column: Top, bed the pipe in the trench; middle, method of connecting to street sewer; bottom, passing pipe through basement wall. Left, below, the trench should be smooth; above, the properly finished job.***

This is an abstract of a Journal Series paper of the New Jersey Agricultural Experiment Station, Rutgers University, which was published in the Health News of the New Jersey State Health Department. Mr. Hansens is Associate Resident Specialist in Entomology at Rutgers.

HOW TO CONTROL INSECTS IN REFUSE DUMPS

ELTON J. HANSENS



● ***THREE popular residents of our bigger and better refuse dumps: The cockroach, left; the fly, center; and the mosquito right.***

DUMPS are normally inhabited by one or more of the following insects: crickets, cockroaches, flies and mosquitoes. These insects may breed in and on the dump in enormous numbers without being noticed, and then suddenly overflow into surrounding industrial or residential areas. It is then that control measures are hastily drawn up and more hastily applied to meet this immediate problem. Few municipalities conduct any planned insect control program for their dumps, even though the cost of such a program is relatively small.

Crickets are possibly the most bothersome insects originating in dumps, which are wonderful breeding places, with abundant organic waste for food and limitless cover. Though few crickets may be seen on the surface, there may be millions down in the dump. Under normal conditions, they will remain there, but increasing population pressure or other causes may result in migration and nuisance. In New Jersey, there are two principal kinds of crickets—the European and the black. The first of these is the more common and important pest.

Cockroaches, similar in habits to crickets, also find a pleasant home life on the dump. The more common roach is the small German roach or croton bug, a well-known pest. The American roach is much larger, and may be 1½ to 2 inches long. These are less common on dumps than the German roach, but may be a serious pest.

Flies and mosquitoes may travel a mile or more from their breeding places. Therefore, they are more commonly recognized as pests, and are more likely to be subjected to control measures. Mosquitoes on dumps are limited to one species, the house mosquito (*Culex pipiens*), which will breed in any accumulation of water, no matter how polluted. Dumps are therefore particularly attractive to them.

The most important species of flies that breed on dumps are the bluebottle and green-bottle blow flies. The lesser house fly is also found on dumps in large numbers, but the common house fly is not generally important at dumps. However, all of the above-mentioned flies are generally regarded as important mechanical conveyors of disease organisms. It is best to determine quite definitely the kinds of flies present on the dump before planning control measures, as methods employed may vary slightly.

Ineffective Control Measures

Control measures often used on dumps are ineffective, or may even aggravate the problem. Garbage, wrapped in paper, affords a convenient housing for the pests. It is practically impossible to wrap garbage in such a way as to exclude insects, and wrapping is therefore ineffective for control.

Often the first thing that suggests itself to officials is to burn the dump and thus destroy these pests. This is about the worst possible treatment for roaches and crickets, since they are merely forced to leave the dump by the heat and smoke and move into adjoining areas, where they may be much greater pests. There are many instances where otherwise harmless and unnoticed cricket and roach infestations have become important municipal problems in a few hours. Fire will not provide insect control and is otherwise undesirable in a dump.

Effective Control Measures

With the advent of the new residual insecticides, control of insects on dumps has become economical and rather simple. For blowflies, 5% DDT emulsion can be used to advantage. These flies often rest in weeds and shrubbery around the dump and treatment of such areas with DDT applied as a spray once a month will give control, though not of all flies. Treatment of the active face of the dump twice a week with 5% DDT emulsion will be generally more satisfactory. Where the dump is large, more frequent treatment may be necessary. As much as possible of the exposed and recently deposited garbage and refuse should be coated with insecticide. In using oil emulsions, there may be some temporary effect on tree leaves and it may be well to test the emulsion used in this respect.

Dusts have been used to a lesser extent in control of flies. They are

easier to apply, require less expensive equipment, and will sift through the refuse better than sprays. For small dumps, a rotary hand duster operated from the top of the dump will give good coverage. A 5% DDT dust may be used. On fly control, DDT is the best, since it will last longer and is completely safe. Garbage to be fed to hogs should not be treated.

Mosquito, Roach and Cricket Control at the Dump

Mosquito control can be obtained by applying fly control methods in such a manner as to cover water-holding debris and to reach the water that is often ponded underneath the dump. The aim should be to insure that any emerging insect resting on any surface is exposed to the insecticide.

Fully satisfactory control of crickets and roaches on dumps is better obtained with chlordane. This gives excellent results when used as either a spray or a dust. A 2% chlordane emulsion or a 2% chlordane dust will give control, but may not kill insects which are deep in the dump. Retreatments at monthly intervals may be necessary. Chlordane will also give excellent control of flies and mosquitoes, but is not as long-lasting as DDT.

Insect control on dumps can be obtained economically and by local personnel with a small amount of training, and with inexpensive equipment. Often as economical a job can be done by a professional exterminator. Information in regard to the control of insects, including insecticides to be used, insects most likely to be a problem, and the method of exterminating them can be obtained from the Entomology Dept. of your State University.

Washing a Slow Sand Filter

A slow sand filter, built for Evans Mills, N. Y., population about 700, is washed in an unusual way. The filter outlet is closed, and water allowed to rise over the sand to a depth of 12 ins. to 18 ins. A 1½-inch hose, with a ¾-inch nozzle, using considerable pressure, is used to agitate the water, stirring up the dirt on the sand surface, but not materially disturbing the sand. The water is then drawn off to a depth of about 6 ins., the agitation with the hose being continued. This process is repeated two or three times. Cleaning is accomplished in about two hours. The only structural change necessary was to install a trough through the centerline of the filter, with the edges flush with the sand surface, to carry off the dirty water. This device was described by the operator, Frank Moore, in New York State Health Department's Water Works News.

The Phenol Waste Problem in the Ohio Basin

One of the most challenging problems in the highly industrialized Ohio River Basin is water-taste contamination from phenol wastes. Despite the best efforts of by-product coke processors and others to reduce the phenolic content of their wastes there remains the need for developing an economically feasible method of reduction of phenols.

The Ohio River Valley Water Sanitation Commission has decided, therefore, that it would employ every resource at its command to explore possible solutions. Its interests are threefold: (1) Improve raw-water quality for municipal uses; (2) determine what permissible limits of phenol pollution, if any, should be granted to those who discharge wastes; and (3) aid industry in its efforts to find a means for treatment of phenols at their source.

To this end the Commission is sponsoring and acting as the coordinator of an intensive research program. In so doing it is enlisting and enjoying the collaboration of private industry, state and federal agencies.

For example, the Wallace & Tiernan Company, with its staff of chlorination experts, is already making laboratory studies on these wastes. On the basis of this research it will be determined whether or not to carry forward pilot-plant studies.

Upon invitation of the Commission, the Armco Steel Corporation of Middletown, Ohio has agreed to collaborate in the work and has provided a field laboratory building.

● ***INCINERATION of garbage and refuse, collected in modern tight collection vehicles, is the best way to control insects at dumps.***

Rating Steam Heaters For Tank Cars

There has been a lot of misunderstanding about capacities of tank car heaters. When tank car heaters were originally put on the market they were rated as one, two or three car heaters. As a matter of fact, this rating means absolutely nothing, because, after all, it is the capacity of the heater itself that counts.

The capacity of a steam boiler or generator is measured by its ability to evaporate water, or to change water into steam. The ability to evaporate 34.5 lbs. of water per hour is considered to be one boiler horsepower, this means the ability to change water, which has already reached the boiling point of 212 degrees into steam at atmospheric pressure at the rate of 34.5 lbs. per hour. To produce the change from water at 212 degrees to steam at 212 degrees, it requires 970.4 BTUs per pound of water. This figure changes at different pressures but 970.4 is the generally accepted figure. From these facts it is evident that to produce one BHP, it is necessary to add 33,478.8 BTUs of heat into the water. This figure is obtained by multiplying 34.5 by 970.4.

For all practical purposes, it is usually stated that a boiler has an equivalent evaporation of a certain number of pounds of water per hour. This means that the boiler can evaporate that many pounds of water per hour, from and at 212 degrees, or provide the equivalent amount of heat transfer in changing water at any given temperature to steam at any required pressure. Littleford's *Elbee Tatler.*

BITUMINOUS RESURFACING BY MACHINE

● ***LAKE STREET, before resurfacing, with street car tracks showing.***

● ***SURFACING laid; section below and text describe methods of applying pavement.***

Sanford F. Giles
Commissioner of Public Works
Oak Park, Ill.

LAKE St., approximately a mile and a half long and 50 ft. wide was resurfaced a year ago. The center 20-ft. strip over the old street car tracks was given a binder course with the screed of the paving machine let down so that it touched the pavement, leveling the existing depressions in the track area and at each rail. A 1½-inch surface course was then placed. To date there has been no indication that our method of surfacing this track area is not entirely satisfactory.

The work was done by contract, payment being made on the basis of gallons of emulsified asphalt prime applied; and per ton of leveling, binder course and surface course in place on the street. The price for these included preparation of the base; priming; placing; leveling and rolling; and furnishing all materials and equipment. Machine spreading was required; also two 3-wheel and two tandem rollers. The work also included manhole adjustment and filling four street drain inlets between the car tracks.

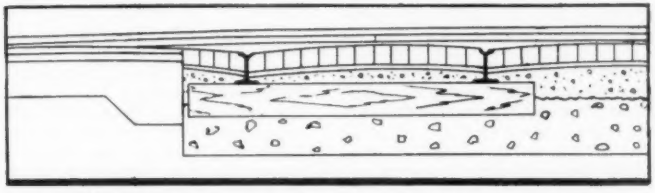
Steps in the Work

The existing roadway was first cleaned of all loose and foreign materials. Heaved and rutted surfaces were removed in advance of the work. There were about 20 such areas from which the old surface was removed and replaced with leveling binder mixture. Pavement removal was paid for on a sq. yd. basis, and the leveling binder mixture on a per ton basis.

After cleaning with mechanical and hand brooms, the surface was primed with EA-1 emulsified asphalt, using 0.05 and 0.10 gal. per sq. yd., depending on the condition of the pavement. A machine laid leveling binder course 20 ft. wide, previously mentioned, was laid over the central car track strip. Following this, a machine laid binder course was laid over the center 30 ft. of the roadway, feathering out to meet the existing pavement at the outer edges by splitting the screed in the center so that the outer 5 ft. of the outer lanes tapered from 1½ ins. to about ½ inch. Over this binder course, a machine laid 1½-inch surface course 40 ft. to 48 ft. wide (depending on the street width) was placed; this was tapered down by hand methods to meet the existing pavement at the gutter edges.

The materials and methods of procedure were in accordance with Illinois Highway Department specifications, using bituminous concrete binder and surface courses, fine graded aggregate type. The surface course mixture used in laying the two outside lanes, the area from the outside lanes to the gutter edges, and the street intersection areas, was modified by using a smaller stone (⅜ inch maximum) to permit a feather edge transition.

Manholes in the area were not adjusted to grade until after the binder course had been spread and rolled. Before applying the prime coat, a ring of pavement around the manhole was broken but left in place. The manhole was covered with building paper during priming and placing the leveling and binder courses. After these courses were placed, the materials over and around the manhole were removed, the cover adjusted to the finished surface grade, and a 7-inch portland cement concrete base replaced around the manhole level with the binder course surface.



● ***SECTION of part of street showing method of covering rails.***

★ The Status ★

OF GARBAGE COLLECTION AND DISPOSAL

N. W. NESTER

THE data submitted herewith are intended as no more than an indication of existing methods of refuse collection and disposal in Indiana. It should be noted that some of the municipalities are already in the process of improving the disposal methods reported herein. However, it is believed that the data reported are typical of many states in the nation. The study shows that many present methods in garbage collection and disposal are inadequate, inefficient, uneconomical and a menace to public health and safety.

The data on which this article is based were obtained from a questionnaire sent to 72 municipalities in Indiana. Of the 72 questionnaires mailed out, 30 were returned. Of the 30 returned, 19 were used in part, while 11 did not contain enough accurate information to utilize in the compilation. Obviously, refuse and garbage quantity and cost records in practically all municipalities are neglected. It is undoubtedly this factor which has prevented better returns on the questionnaire.

Cost Records Are Lacking

It is customary for municipalities to keep adequate records on water consumption and sewage disposal. State health authorities require local governments to submit monthly reports on water and sewage analyses. Other municipal operations such as paving maintenance and street cleaning are recorded and constantly scrutinized for inefficiencies and high costs. Municipal officials should maintain adequate similarly sound records on garbage collection and disposal for the purpose of operating at greater efficiency and at a lower cost to the taxpayer. Perhaps state health authorities should require monthly data on garbage disposal as a public health function.

It is impossible to use the data given here on a comparative basis. Differences in methods, size, density of population in the community, weather, terrain, labor conditions and other factors make the data presented by the various municipalities impossible to average or compare. However, an analysis discloses many interesting facts.

The information on methods of disposal shows that every type of disposal is represented. It reveals that, despite condemnation by public health authorities of the practice of feeding raw garbage to hogs, this method of disposal is prevalent throughout the state. The U. S. Public Health Service reports that some 5% of garbage fed hogs are infected with trichinosis. However, there are no figures available on the incidence of trichinosis in humans which may be directly attributable to the infected hogs. Until such time as these data become available and local and state health groups ban by law the practice of feeding raw garbage to hogs, this method of disposal will remain popular.

No comment will be made on the use of dumps as a means of disposal. This author has never seen a dump that was free from rats, fire, flies, smoke or other conditions which might prove nuisances or menaces to public health.

It is surprising to note the lack of sanitary fills and incinerators reported. Particularly is this true of the sanitary land fill, a method which grew in popularity during the war. Many towns have areas available which could be utilized for sanitary fill purposes. Apparently, the advantages of this method have not been fully appreciated by our municipalities.

Data From the Questionnaires

Of the questionnaires returned, 18 indicated that collections were made by municipal forces while 7 collected garbage under contract. While this information does not show definitely that municipal collection is more economical, national surveys made by technical magazines have shown considerable savings where the operation is accomplished by municipal forces—provided the operation has been properly planned and is functioning efficiently. It is logical to assume that a municipality can make collections more economically than a contractor who is in business to make a living.

Information on point of pickup discloses that a number of municipalities are rendering luxury service, regardles of cost. It is evident that back door collections are going to be expensive as compared to curb pickups. Where both types of pickups are practiced, the taxpayers who are receiving only curb service are paying for backdoor service for their neighbors. In many instances this type of situation can provide the superintendent of collection with many complaints as well as general dissatisfaction in the community.

The questionnaires also contained data on frequency of collection. The answers returned ran from "varied" and "daily" to "twice in summer, once in winter." Here again is evidence of so-called luxury service in some areas with inadequate frequencies in others. This information indicates the necessity for further study to determine a frequency which would not be prohibitive in cost but would provide service often enough to discourage harborage for rats and breeding places for flies. Each community may of necessity present a somewhat different problem, though nearly all will be essentialy the same.

It is encouraging to note that of the cities sampled, 16 are using closed body trucks, while only 9 are still using the unsanitary open dump truck. This indicates a trend of elimination of the old open wagon which dripped liquids along the public thoroughfares, as well as a means of transportation for flies.

The cost figures given cannot be utilized for comparison purposes, since there are obvious errors in the submission of data.

Labor is normally short for collecting garbage. Few men want to be called a "garbage collector." Some municipalities have substituted "Sanitation Department" for the usual Garbage Collection Division and refer to their men as laborers in that division. While the name has a purely psychological effect on the worker, in many cases

the title has aided in obtaining qualified help for the job.

The data indicate that little attention has been given to the size of the container supplied by residents. Certainly a 50-gallon drum is too unwieldy and heavy for efficient handling, even by two men. Depending on frequency of collection and living habits of the occupants of houses in particular areas, an efficient size can be determined. Normally this varies from 5 to 10 gallons for separate collection to 15 to 20 gallons where the garbage is mixed with combustible refuse.

Improving Labor Conditions

Supervising Engineers and Collection Superintendents should attempt, wherever possible, to make the work of garbage collection a desirable position. This can be accomplished through regulation of size of container, short walks to point of pickup, enclosed trucks, reasonable length of routes, fair salaries (with possibly incentive pay and working hours). It might prove economical to provide collectors with coveralls, raincoats and galoshes; and certainly the men should be provided with lockers, washrooms and shower baths.

Seven of the questionnaires returned were marked "no organized collection service." Three were marked "no information available." How can an operation be efficiently controlled if the administrative head has no facts or figures on which to base a comparison? It is unfortunate —and almost universally true, particularly in the smaller communities —that garbage collection and disposal is one of the most neglected and abused operations in municipal administration. While the larger cities have, to some extent, modernized and increased the efficiency of the refuse collection operation, there is a great need for improved systems through engineering studies in the smaller communities.

To summarize, the results of this study should confirm what many of our municipal officials suspect—that garbage collection and disposal in many of their communities is operated in a most haphazard manner. Record keeping and cost accounting of the operation should be instituted. Sanitary practices in collection and disposal are medical problems. Collection and disposal of garbage should be investigated, planned, installed and supervised by engineers. Economies resulting from such sound practices justify investigation by all officials concerned in municipal operation.

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The Use of Bituminous Materials for CURING SOIL-CEMENT Surfaces

SOIL-CEMENT, like other structural materials using portland cement, needs to be protected against rapid drying immediately after construction and during the early hydration period. A number of materials have been used successfully to provide a moisture retaining cover, including waterproof paper, moist straw, earth, hay and sawdust, and bituminous materials. The use of bituminous materials is increasing. This is primarily due to the fact that they are easily and quickly applied and apparently are quite effective moisture retainers. In many instances they serve not only as the moisture retentive cover but as a tack coat for the subsequent bituminous surface course.

The Soil-Cement Committee of the Highway Research Board, with the cooperation of the State Highway departments of Illinois, Kansas and Nebraska and the city of Little Rock, Arkansas, has endeavored to evaluate the effectiveness of bituminous materials in retaining moisture in soil-cement for seven days following construction. The data collected by these four agencies and the conclusions drawn from them were published in September, 1949, by the Board, and are briefly abstracted herewith.

Results of Field Tests

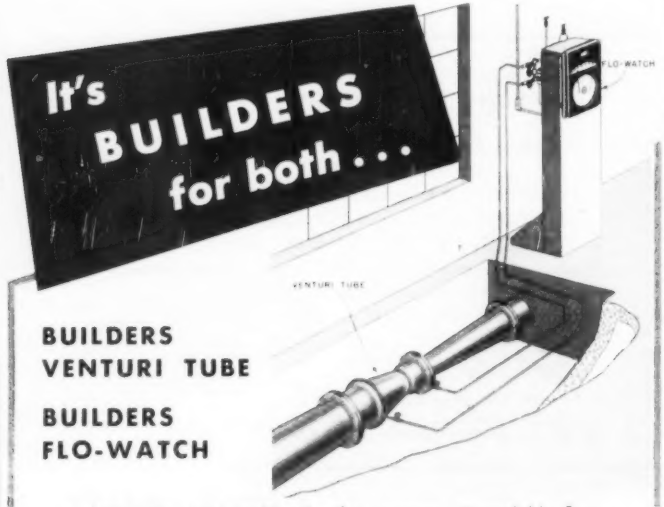
Field tests conducted by all four agencies were similar, except in minor detail. The primary data consisted of moisture determinations at locations having bituminous cover and at adjacent locations without cover. The determinations were made daily for seven days in a top layer ¾ in. thick and in a second ¾-in. layer immediately below the top layer. The bituminous material was applied immediately after surface finishing of the soil-cement. Special note was made of the texture and moisture condition of the surface of the test areas at the time of application of the bituminous material, and to the adhesion of the bituminous material to the soil-cement during the test and at the end of 7 days. The materials used included a MC-2, RC-1, a negative Oliensis spot MC-3, and an asphaltic emulsion.

The following general conclusions were drawn from these four field experiments.

Asphaltic cover materials, as used on the experimental test sections, were very efficient in maintaining moisture in the soil-cement for the first seven days following construction. Failure to prevent surface moisture losses produced an inferior layer of soil-cement in the surface.

The asphaltic cover material should be applied the same day as construction and as soon after surface finishing is completed as construction conditions will permit.

A tightly knit and even surface should be produced in final finishing and the surface moisture in the soil-cement should be such as will prevent penetration of the bituminous material. The surface moisture condition will vary from field optimum moisture for the heavier and faster curing bituminous types such as RC-3, placed during the hot summer months, to a water saturated surface condition for the lighter and slower curing bituminous types



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such as SC-1. placed during the cool spring and fall months.

The bituminous cover materials used on these experimental test sections adhered firmly to the soil-cement when applied to a soil-cement surface having tightly knit surface and a surface moisture condition which prevented penetration of the bituminous cover materials.

Penetration of the soil-cement by the bituminous cover material materially reduced the efficiency with which the bituminous material adhered to the soil-cement, and also lowered the hardness and quality of the soil-cement.

For soils generally used on soil-cement construction, the surface texture will be such, that 0.15 to 0.20 gal. per sq. yd. of bituminous cover material will produce a suitable bituminous film. The quantity used should be sufficient to give complete coverage with a trace of run-off in places. Coarse, opened textured soils, such as an A-3, and irregular surfaces containing numerous pockets and equipment tracks will require more bituminous material to compensate for the quantities retained in these pockets and equipment tracks and the quantities required to fill the open, surface voids.

When traffic must use the soil-cement before the bituminous material is no longer sticky and tacky, a sufficient cover of stone chips or sand is necessary to prevent pickup from traffic. About 10 lb. per sq. yd. of stone chips of sand will give sufficient aggregate cover to prevent pickup.

Properly protected bituminous cover materials, after suitable curing, may also serve as the prime and tack coat material for the final bituminous surface.

Dual-Fuel Engine for Columbus Sewage Treatment Plant

A new engine has been purchased by the city of Columbus, O., for use at its sewage treatment plant. This is a Superior engine, 8-cylinder, supercharged, 1,440 hp. It will operate on sewage sludge gas (650 btu), natural gas (1,000 btu) or fuel oil (140,000 btu per gal.), in any proportions, ranging from 10% up. It converts instandy and automatically from gas to fuel oil, without any mechanical change, by pressing a button. Indicator lights show what kind of fuel is being used.

Testing 10,000 Meters a Year

The Indianapolis Water Co. has about 100,000 meters, of which about 97% are ⅝-inch. Testing of about 10,000 meters is necessary every year. The Ford Meter Box Co., working with the engineers of the Indianapolis Water Co., developed a test bench to which twelve ⅝-inch meters are clamped hydraulically. Retraction of the clamping cylinder automatically opens up a space of about ¼ inch at each meter pedestal, making insertion and removal of the meters quick and easy. A spring-loaded fork holds the meter upright, also automatically.

After the meters are clamped in place and air is flushed out, a test dial is put on top of the regular dial and adjusted to zero reading. Test flow is then started. This is continued until the water level in the effluent measuring tank rises to a predetermined level, when flow is electrically stopped. Accuracy is read from the test dial and entered on the test card; then the dial is adjusted and another test run started. Meters are tested at three rates of flow, and three tanks are provided for tests at 2 cu. ft., 1 cu. ft., and 0.1 cu. ft. Rates are controlled

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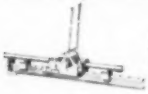

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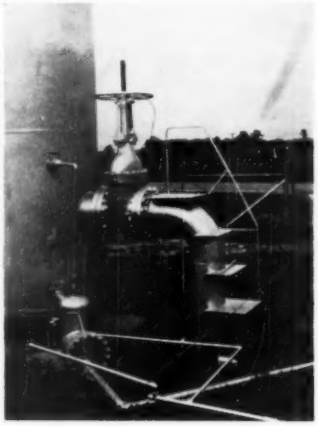
Elton Sterrett

To safeguard the operator while manipulating the discharge valve on a supply tank, a stairway and platform, fabricated from tank plate scrap, enable him to work at the proper height and maximum leverage. The platform and steps are formed from light steel plate, one edge cut to fit the curve of the pipe, and welded at heights to form easy stairs. A railing, of light rod, welded to one side of the steps, serves to brace them and to provide handhold while using the steps.



Steps and rail provide safety for valve operator.

After being welded in place, a coat of aluminum paint protects the metal and adds to the attractive appearance of the stairway.

As the steps are all carried on the riser and elbow of the discharge pipe, they do not interfere with the flanges or bolts which hold the valve in place, and that unit can be changed without removing or altering the set-up.

How Long Does It Take to Heat a Tank Car?

Many things must be taken into consideration when answering this question. Among the factors involved are: (1) whether the car is insulated or non-insulated; (2) the type of coil the car has, it can be either single or double coil; (3) the atmospheric temperature while the car is being heated; (4) the temperature of the material when the car arrives on the siding, as well as the temperature to which the material must be heated before it can be loaded; (5) the type of material to be heated; (6) the condition of the coils in the car, and (7), the maximum pressure that the heating coil in the car will stand.

Based on average conditions and average material, when using an insulated car with a double coil system, the average temperature increase with a Littleford Heater will be 20 to 30 degrees F. per hour. When the car is cold, the temperature increase will probably run higher than this, but as it gradually becomes hotter, the temperature increase per hour will be less.

When the temperature gets near 300 degrees, the increase per hour will probably not exceed five to ten degrees. The practical limit to which the average tank car can be heated with a steam type heater is 300 deg. This is true because 200 lbs. steam has a temperature of approximately 388 deg., consequently there is not sufficient difference between the steam and asphalt to cause rapid temperature rise.

If the car is not equipped with insulation, if it has a single coil, or if the outside temperature is exceedingly low, then all of these factors will help cut down on the hourly increase, and it will take longer to bring the car to application temperature. Littleford's *Elbee Tatler*.

What Chlordane Is

Chlordane is the common short name assigned by the U. S. Government to the chlorinated hydrocarbon insect and pest toxicant designated as having the empirical formula $C_{10}H_6Cl_8$. The active toxicant is prepared commercially as "technical chlordane" which is the 100% active compound from which concentrates and insecticides are made. Chlordane can be dissolved in oil, emulsified in water or combined in powder form. For general use, chlordane preparations should contain not more than 2% of the active toxicant.

Public Works ENGINEERING DATA

Digester Gas Engines Yield Profit

Toledo, Ohio, late in 1936, installed two gas engines using digester gas to operate its 36 mgd sewage pump, which was then 14 years old. In his report for 1948, A. H. Niles, Engineer-superintendent of the disposal plant, said that the pump averaged 31.8 mgd, or 363 gal. per cu. ft. of gas. The cost of pumping was $6,217.53, but would have been $24,747.41 if the power had been purchased. The engines cost $41,075 and in the 12 years have saved $170,909. Sludge is made into fertilizer and was sold in 1948 for $17,410. Sewer rental revenues totaled $276,675. Part of the income is used for other municipal purposes.

Paving 14 Blocks in One Day

With the help of equipment worth $2,500,000, seven contractors laid 14 blocks—25,000 sq. yds.—one mile—of pavement in Baltimore, Md., in one day. The work, which was done on Sunday, began at 5:30 a.m. and was completed at 9:30 p.m. Some intersections were completed by 3:45 p.m. Pavement was asphalt; 365 men, 83 trucks, 10 pavers and 20 rollers were employed.

Cost of Laying Water Pipe

For the year 1948, costs of laying water pipe, as reported by the Water Bureau of Hartford, Conn., were: For 4-inch, 281.9 ft., labor $2.309 per ft. and materials $1.293, a total of $3.324 per ft. For 6-inch pipe, costs, with machine trenching, on 11,398 ft. were $1.210 for labor and $2.071 for materials, a total of $3.805. On 5,950 ft. of 6-inch pipe on which trenching was furnished, the cost was $2.349 per ft.

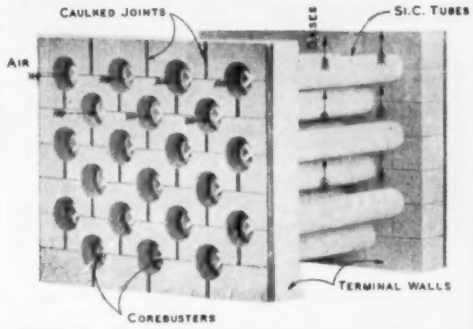
On 44,576 ft. of 8-inch pipe, with machine trenching, costs per ft. were $1.011 for labor, $2.712 for materials and $0.614 for miscellaneous, a total of $4.337 per ft. For 10-inch pipe, comparable costs on 5,547 ft. laid were $1.444, $3.321 and $0.610, a total of $5.375. On 43,170 ft. of 12-inch pipe, costs per ft. were $6,474; and on 397 ft. of 16-inch were $8,561.

Title—Public Works Planning

Quantities of Screenings and Grit Removed from Sewage

The quantity of screenings removed from the sewage during 1948 at the treatment plant of the Minneapolis-St. Paul Sanitary District averaged 0.9 cu. ft. per million gallons of sewage. This is about the average for the plant over the past nine years. The largest amount has been 1.1 cu. ft., and the least has been 0.8 cu. ft. The quantity of grit averaged 3.9 cu. ft. per million gallons. Of the grit, an average of 13.6% was composed of volatile solids. During nor-

first step to a better incinerator...
FITCH AIR HEATERS



Fitch Recuperators (air heaters), by providing for the individual replacement of tubes when necessary, have an indefinitely longer life than the average heater. *Bulletin No. 11 explains why. Address:*

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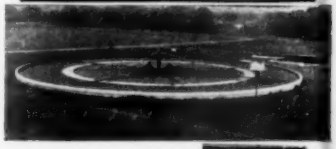

P.F.T. Rotary Distributors provide a practical, efficient unit for dosing sewage to filter medium, in minimum area and with minimum piping. Operate at minimum head, frequently eliminating piping. Features include patented spreader jets that assure full, even coverage of the filter bed; triple valves and a positive mercury seal. Ask for Bulletin No. 213.

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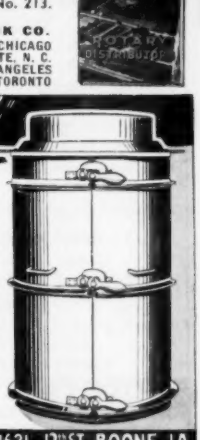

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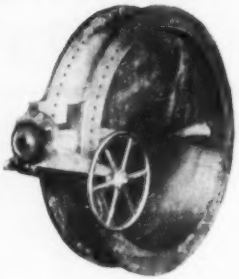

- For controlling flows from secondary settling tanks; for recirculation in biofilter plants; in low pressure water jobs.
- For handling effluent from primary tanks.
- For controlling flow in water or sewage treatment or sludge.

This 66" Butterfly Valve was recently shipped to an activated sludge plant for use on a 7½ lb. air line.

Rockwell Slide, Kwikleen and Butterfly Valves are made of any metal, in 1" to 84" pipe sizes, for pressures to 100 p.s.i., with manual or automatic controls. Get our catalog.

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Fig. 1

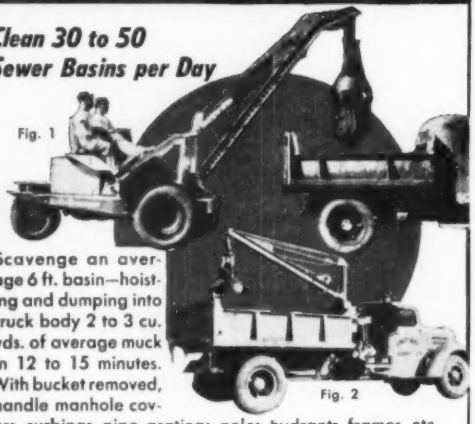

Fig. 2

Scavenge an average 6 ft. basin—hoisting and dumping into truck body 2 to 3 cu. yds. of average muck in 12 to 15 minutes. With bucket removed, handle manhole covers, curbings, pipe, gratings, poles, hydrants, frames, etc.

Fig. 1—Model A2 *KRANE KAR* Swing Boom Mobile Crane . . . self-contained unit.

Fig. 2—Model Q2PX for mounting on standard motor truck, with or without dump body.

A FEW USERS: City of Scranton, Pa.; Township of Endicott, N. Y.; Kearny, N. J.; Freeport, L. I.; New York City.

Bulletin No. 67 Tells the Story . . . Ask for It.

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mal dry weather flows, velocities in the grit chamber were held at 1.2 feet per second, but during storm runoff periods were about 0.6 feet per second. In the preceding year, grit amounted to 3.6 cu. ft. per mg. and in 1946 was 5.6 cu. ft.

Costs of Meter Repair and Testing

Costs are now available for the years 1947 and 1948 for meter repair and maintenance for St. Paul, Minn. During this period, 3,069 new meters were installed; 9,595 meters were reset; and 9,928 meters were repaired. Costs of maintenance per meter per year for 1948 were: ⅝-inch, 15.26¢; ⅝ x ¾-inch, 12.41¢; ¾-inch, 17¢; 1-inch, 18.05¢, 1¼-inch, 27.66¢; 1½-inch, 25.57¢; and 2-inch, 49.88¢.

The average cost of disconnecting ⅝ to 2-inch meters in 1947 was $1.10, and in 1948 it was $1.20. Disconnecting meters 3-inch and larger averaged $10.93 for the two years. Resetting the smaller meters, ⅝ to 2-in. cost $1.13 and $1.20 for the two years. Average cost of repairing ⅝ to 2-in. meters was $5.73 and $6.18 for the two years.

Reasons for disconnecting meters, which were about the same for the two years, were, for meters under 2-inch: Burnt, 10.4%; frozen, 4.7%; defective, 13.8%; sand, 16.0%; defective register, 10.4%; leaking, 23.6%; other reasons included noise, poor pressure, changes in plumbing and "not justified."

Detergents For Street Cleaning

According to Dr. Lawrence H. Flett, president of the American Institute of Chemists, speaking before the Detroit section of the American Chemical Society last November, modern synthetic detergents are being used to clean everything, from babies to railroad terminals, and within a few years will be used for cleaning street pavements. Cleaner streets can be assured by the application of detergents so powerful that five pounds can wash a mile of highway, he said; emphasizing that the use of the new products will mean less dirt tracked indoors, fewer unpleasant odors, and less filth and disease.

Sewage Effluent for Industrial Water

San Leandro, Calif., whose 1.7 mgd. of sewage effluent is currently flowing into San Francisco Bay, plans to reclaim this for industrial use. At present, the treated sewage is said to contain 50 ppm of suspended solids, which can be reduced to 20 ppm with slight additional treatment. Present cost of industrial water in this area is $170 per mg. It is estimated that the reclaimed effluent can be delivered to industrial areas near the plant for about $50 per mg.

Radioactive Isotopes for Water and Sewerage Research

The use of radioactive isotopes has advantages over salts and dyes for measuring horizontal mixing in water and sewage treatment processes, according to Harold A. Thomas, Jr., and R. S. Archibald, in a paper before the American Society of Civil Engineers. The greatest advantage is perhaps the fact that isotopes can be detected in extremely small concentrations, so small that they do not cause observable density currents which may disturb flow patterns.

The presence of the isotopes can be identified by many types of Geiger counters which give precise results, and tracing is possible through concrete walls,

eliminating the need for sampling. No chemical or biochemical reactions interfere with the rate of disintegration of the isotopes; temperature changes have no effect; and absorption of the tracer can be made negligible by proper choice of isotope.

Aluminum Alloy Equipment for Activated Sludge Plant

The first sewage treatment plant to have aluminum-alloy fabricated mechanical equipment is the activated sludge plant at Point Comfort, Tex. The plant, which was designed by Wyatt C. Hedrick of Houston, consulting engineer, uses Yeomans equipment and is intended to serve 600 people. This is a so-called "package" plant. Equipment includes an aerator, a pneumatic ejector for handling screenings and primary sludge, two 4-inch pumps for sewage, an effluent return pump, and a digester. It is stated that the use of aluminum alloy did not noticeably affect the equipment cost.

Zeolite Softener Reduces Lime Feeder Troubles

When lime is being fed as a solution, plugging of the feed line may occur. N. M. Fuller, water superintendent at Batavia, N. Y., writing in the New York State Health Department Water Works News, tells how he solved this problem. Adding lime to tap water resulted in a softening reaction, so he used a zeolite softener to provide water of zero hardness to the lime feeder, and his troubles were over. Though some lime may deposit, it is soft and easily flushed out.

Mapping Cincinnati and Hamilton County

A comprehensive program for mapping the city of Cincinnati and Hamilton County is under way. Estimated cost is $1,120,000, with costs shared by the city and the county. Each pays for mapping its own area except for a 3-mile wide strip contiguous to the city, on which each pays one-half. The USGS provided all needed precision instruments and, on the basis of repayment of costs, skilled personnel. This project was described by Henry H. Kranz, city engineer of Cincinnati, in a paper before the American Society of Civil Engineers.

Handling 300,000 Tons of Sludge

To insure elimination of odors around the Back River sewage treatment plant at Baltimore, 300,000 tons of sludge have been loaded into trucks for free disposal to farmers, gardeners and others. The sludge was handled with a front-end bucket loader or tracto-shovel which was mounted on an Allis-Chalmers HD-5G tractor.

Controlling Water for Air-Conditioning

Several cities now control the use of water for home and office air-conditioning by passing regulatory ordinances prohibiting the discharge of water into the sewer system at a rate in excess of one gallon per minute per front foot. Elmira, New York, does not allow installation of air-conditioning equipment that will deposit waste water into the city sewers. In New York all air-conditioners using more than five gallons of water a minute must be equipped with a water-conserving unit, such as a recirculating device or a water-cooling tower; and Philadelphia requires economizers where maximum water use ex-

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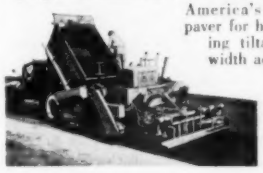

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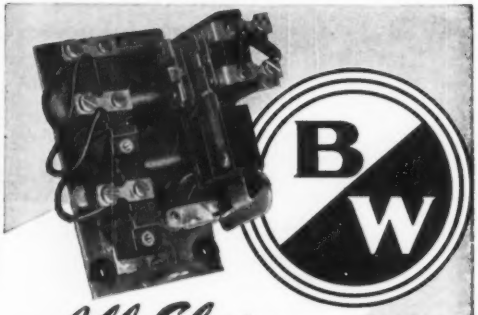

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ceeds 10 cubic feet a minute. Other cities regulating use of water for air-conditioning include Champaign and Urbana, Illinois; Rochester, New York; Richmond, Virginia; Kenosha, Wisconsin; Reno, Nevada; and Washington, D. C. *Public Management.*

Pollution Research in England

FOR many years the Ministry of Agriculture and Fisheries has operated "cleansing stations" in which mussels taken from polluted coastal waters are cleansed of bacteria before being sold to the public. At some ports on estuaries at which mussels are landed, however, the water available is not salt enough at all states of the tide to be used in the cleansing process. Small-scale and semi-scale experiments in previous years have shown that sea water (which at one of these ports would be pumped from the estuary at high water of a spring tide) could be treated and re-used for cleansing successive batches of mussels. The process of treatment includes addition of sodium hypochlorite, and aeration to remove excess chlorine and to re-oxygenate the water. This process has now been thoroughly tested and the method of operation and results obtained are described in the report. A full-scale plant is at present being designed.

Sewage—At some sewage-disposal works in built-up areas nuisance may be caused during warm weather by the small flies which emerge from the percolating filters used in the treatment of sewage. Investigations during previous years had shown that these flies could be controlled successfully by application to percolating filters of Gammexane or DDT, provided that the filters did not contain too great an amount of biological film. With filters treating sewage at a high rate and containing much film, the treatment was not so effective. During 1948, therefore, this problem of treating heavily loaded filters was studied in more detail and it was found that the flies could be controlled effectively by applying Gammexane in the form of a water-dispersible powder, except when the filters were in a water-logged condition. This investigation has now been completed and it is clear that, apart from exceptional condition flies can be controlled by application of Gammexane without affecting the efficiency of the filters or causing the discharge of a poisonous effluent to a river.

The report also contains a description of further work on treatment of sewage by different processes of biological filtration, of experiments on the treatment in percolating filters of a sewage containing added spent gas liquor, and of work on the removal, by rapid filtration through sand or anthracite, of fine suspended matter from settled effluent from sewage works. This last process is of interest at certain sewage works where the effluent has to be discharged into a stream which affords very little dilution.

Investigations are described of waste waters from the washing of wheat and the steeping of barley and of the treatment of effluent from the manufacture of cider and the pickling of steel. The most detailed work, however, was on the treatment of waste waters from electro-plating and particularly of those containing cyanides. Discharge of waste waters of this kind is often responsible for the death of fish in rivers. A procedure is described by which cyanide can be removed by treatment of the liquids with bleaching powder or sodium hypochlorite under controlled conditions.

PUBLIC WORKS DIGESTS

SEWERAGE AND REFUSE . . 69 • HIGHWAYS AND AIRPORTS . . 76 • WATER WORKS . . 80

This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

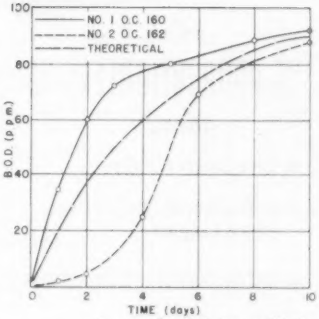
THE SEWERAGE AND REFUSE DIGEST

The B.O.D. Method vs. The O.C.

The effect of sewage or industrial wastes in depleting the dissolved oxygen content of the receiving water is generally accepted as the most direct index of the strength of the sewage. The strength is measured by one (or both) of two methods which have been developed and accepted as standards—the B.O.D. and the O.C. The former employes bacteria, measuring their oxygen requirements. The O.C. (oxygen consumed) method utilizes chemicals to measure the carbonaceous oxygen demand of the sewage.

As presently used, the B.O.D. determination involves incubation for five days, the longest incubation period that will generally include only the carbonaceous oxygen demand. Nitrification may or may not occur during this period. The dilution or concentration of the sample during the incubation period may affect the values obtained. The composition of the dilution water in the analyses of industrial wastes is intricate. Obtaining a proper seed may be difficult. The velocity of the oxygen utilization in typical sewage samples varies greatly during the 5-day incubation period. Care must be used to exclude toxic substances.

The O.C. method fails to include some substances, e.g. alcohol and acetic acid. It is impossible by its use to differentiate between those portions of organic matter that are available to bacteria and those that are unavailable, such as paper. Potassium permanganate was for many years the principal reagent used; but the use of other oxidants, including dichromates, is being advocated, the principal advantages of which are that they are rugged, rapid, reasonably accurate, free from the interference of biological variations, and capable of producing results which can readily be reproduced with most of the organic constituents likely to be found in sewage and many industrial wastes. The authors believe that much more can be learned about a sewage or industrial waste from a careful comparison of the O.C. and B.O.D. values that can be learned from either test alone.



Courtesy Water & Sewage Works

• ***Comparative BOD and OC values.***

R. S. Ingols, J. C. Hildebrand and G. M. Ridenour—"Measuring the Strength of Sewages and Trade Wastes by B.O.D. or O.C."; *Water and Sewage Works*, January.

150-Ton Incinerator

Alhambra, Calif., population 51,338, collects about 80 tons of combustible refuse per day. It has contracted for an incinerator with a capacity of 150 tons per 24 hr. of refuse consisting of 20% unwrapped garbage and 80% rubbish. Contract was let for a Nichols monohearth incinerator for $239,800, with a guaranteed maintenance and operating cost of $0.63 per ton. By substituting a brick-lined steel stack for a brick-lined concrete one and omitting a canopy at the entrance, the price was reduced to $227,700. The charging opening is covered with a motor-operated door mounted on wheels. The furnace is contained in a vertical cylinder 15 ft. in diameter lined with 13½" of fire brick and insulation. Fly ash is removed in a spray chamber. An induced draft fan discharges into a stack of 6 ft. inside diameter 125 ft. high. The operator can control the furnace, forced draft fan and induced draft fan by push buttons on the operating floor.

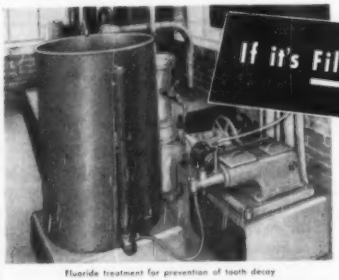
Linne C. Larson—"Mechanically Stoked Incinerator for Alhambra's Wastes;" *PUBLIC WORKS*, Jan.

Standards for Stream Sanitation

State and federal laws for controlling "stream pollution" are receiving increasing attention, and the question arises—what is pollution? Pure water is unattainable, and pollution is therefore a relative term. In defining allowable pollution, one of the earliest standards was expressed in terms of the number of cu. ft. per sec. of stream flow necessary for each 1,000 tributary population. Another frequently used refers to the quality of effluent at point of discharge into the water course. It might seem simple to adopt special effluent standards for each water-

course applicable to all industries and municipalities discharging into it; but this might not use the absorptive capacity of the stream to best advantage. More recently, specifications of the desirable qualities of the waters for particular uses are being recognized as the most reasonable and equitable approach to pollution control. No one standard would apply to all the waters of a given state, but there can be a general minimum standard for effluents, dictated by reason, logic and common decency. The author suggests: 1—Practically complete removal of settleable and sludge-producing solids. 2—Removal of floating solids and practical freedom from visible oil and grease. 3—No free acid or alkali (pH range 5.0 to 9.0). 4—No chemicals or other materials in quantities resulting in concentrations toxic or inimical to man, fish, or normal aquatic life after admixture with the receiving waters. 5—Reduction of oxygen-demanding materials (B.O.D.) so that resulting dissolved oxygen (D.O.) in the stream is maintained above 5.0 ppm. Having determined the permissible pollution for each zone of a stream, this can be allocated among the various sources of pollution so that each will be allotted a fair and reasonable part of the stream's capacity for disposing of the combined effluents. The author suggested in detail a method for working out such allocation, taking into account the proportion of the total waste contributed by each, the number of employees, the assessed valuation, and the amount of the chief polluting substance.

Charles C. Agar—"Stream Standards and Their Practical Application." *Sewage Works Journal*, November.



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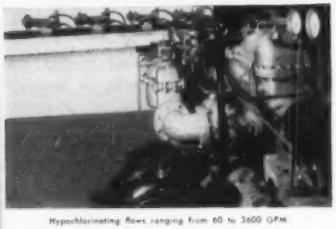
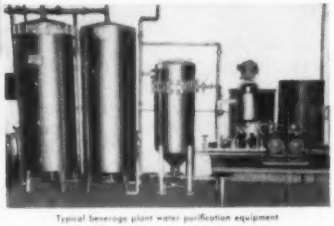
- pH CONTROL
- DIATOMACEOUS FILTERING



Hypochlorinating flows ranging from 60 to 3600 GPM



Typical beverage plant water purification equipment

Diatomaceous filters for swim pool

In communities of all sizes, from small town to giant city, %Proportioneers% has solved the problems of water purification and filtering. With experience gained from over 27,000 installations, %Proportioneers% knows the answers and can save you money. It pays to bring your water treating problems to us! Bulletins on request.

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Small Treatment Plants

In designing treatment plants for summer camps and hotels, it must be noted that peak flows will be higher than at municipal plants and variations rapid; the sewage probably will be more concentrated, contain more grease during hours of kitchen operations, and a greater proportion of volatile matter. Laundry operations may cause interference with secondary treatment. The treatment may be by septic tank or Imhoff tank, followed by subsurface leaching, intermittent sand filter, or contact bed. For the larger plants, package plants utilizing activated sludge or contact aeration are available. In most cases, hand-raked bar screens should be provided. Consideration should be given to the probability of seasonal use, operation by untrained operators, and should provide inoffensive operation and pleasant appearance. If possible, the design should permit construction by relatively unskilled hand labor.

John J. Baffa—"Sewage Treatment for Summer Camps and Hotels;" *PUBLIC WORKS*, January.

Tachographs On Refuse Trucks

Because of complaints that its garbage collectors were "soldiering" on the job, Milwaukee, Wis. in 1948 put a tachograph on one of its trucks. This showed a 40-minute stop at one house, and it was estimated that unauthorized delays added 30% to the cost of collection. The crew threatened to strike and the tachometer was removed; but the council has now decided to put tachographs on all the city trucks used for garbage and ash collection.

John Hubel—"Tachographs on City Refuse Trucks;" *PUBLIC WORKS*, January.

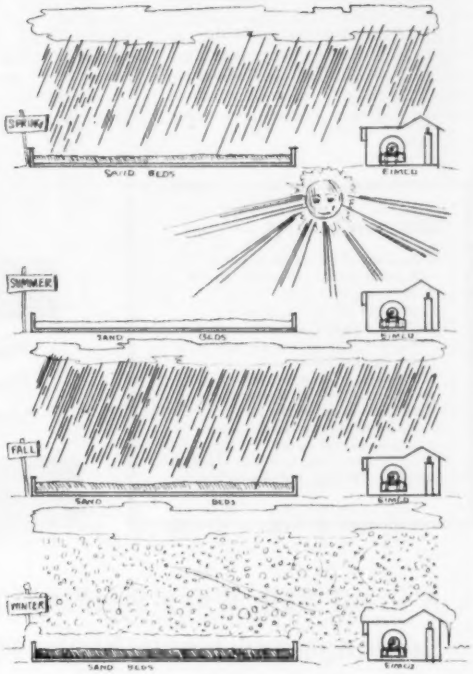
EIMCO FILTERS FOR YEAR 'ROUND SLUDGE DEWATERING

Eimco Vacuum Filters are the only satisfactory year round sewage sludge dewatering equipment.

With the present cost of construction there are many advantages to dewatering sludge the sanitary vacuum filtration method.

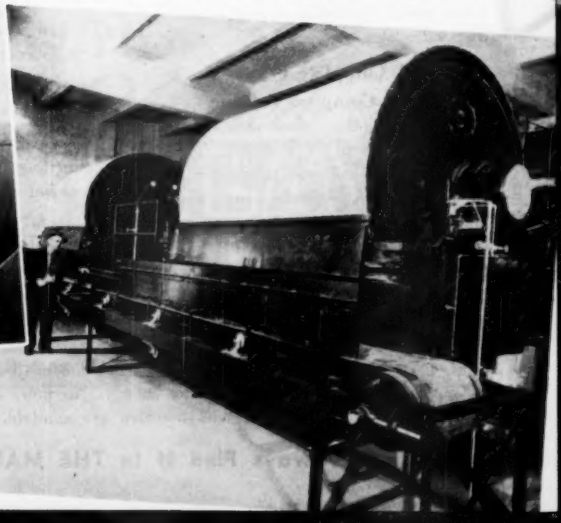
Vacuum filters occupy so much less space and are so easily kept clean and sanitary that they are worth additional expense, but figuring construction costs alone the vacuum filter will cost about the same or perhaps less for the average city.

In any season of the year you can depend on Eimco Sewage Sludge Dewatering Equipment to perform its regularly prescribed task.



SPRING—rain retards drying in Sludge Bed. SUMMER—is drying season in sludge beds. AUTUMN—Usually rain to retard drying. WINTER—Snow and freezing weather add moisture that must be dried out later.

Picture below shows typical Eimco Sewage Sludge Installation.



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Use of Lime In Digestion

The Connecticut State Health Department believes that there is a place for proper liming of digesters, either heated or unheated, and of digestion compartments of Imhoff tanks. But the liming should be carefully controlled, the lime being added in small quantities daily or twice weekly, and mixed with the flow of raw sludge wherever possible. It should not be added in large amounts, infrequently, or dumped in one place in a tank. Methods of liming suggested are: 1—Sprinkling dry lime lightly over the scum and mixing it in by hosing or plunging. 2—Sprinkling dry lime lightly into the flow of raw sludge in a manhole on the way to the digester. 3—Adding milk of lime, either through a submerged pipe (if continually moved), through the suction of a sludge pump, or by spreading over the scum in the gas vents. When starting an unheated digestion tank, regular liming at about 50 lb. per 1,000 population per week will avoid the period of septic, odorous, acid digestion frequently noted during the first 3 months. But liming is generally not needed for a heated and properly operated digester whose capacity is at least 2.0 cu. ft. per capita for domestic sewage, more when industrial wastes are present; 2.5 cu. ft. when secondary sludge is pumped to the digester; 3.5 cu. ft. or more if the tank is unheated.

J. Henry L. Giles—"Liming of Sludge Digesters or Digestion Compartments;" *Sewage Works Journal*, November.

Chromium Removal By Ion Exchange

The removal of chromium compounds in dilute waste waters from the metal plating processes presents problems not yet solved satisfactorily, from the standpoint either of producing chromium-free water or of recovering valuable chromium compounds. The methods used at the present time are: 1—Reduction and precipitation with various compounds with subsequent disposal by dumping or burial. 2—Precipitation and partial recovery of the desired constituents by electrolysis. Experiments were conducted at Purdue University using commercial ion exchangers, using both anion and cation resins. The resins were found to be effective in removing the chromium from solution, but no satisfactory methods have been developed for regenerating the resins by direct replacement reactions.

Don E. Bloodgood and Aubrey Strickland—"Chromium Removal by Ion Exchange, *Water & Sewage Works*, January.

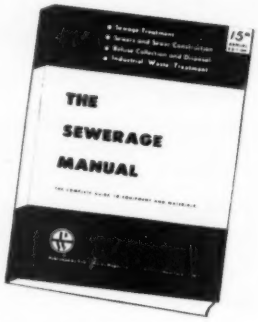
Retention Basin Instead of Storm Sewer

An 1100-acre drainage district of Buffalo, N. Y. is often flooded by storms of greater than "4-times-a-year" intensity, being served by combined sewers of insufficient size. Because of the size and depth required for a relief sewer and unfavorable ground condition, such a sewer would be very costly. Instead, the city has utilized an old quarry to convert it into a retention basin with 2,350,000 cu. ft. capacity into which excess storm water beyond the capacity of the existing combined sewer is diverted, and pumped back into that sewer as the flow in it diminishes. Flow regulation devices divert excess storm water into new drains, which discharge into the retention basin; and an automatically actuated station pumps it back into the sewer when the flow in this falls below a given level. To minimize the amount of sewage matter reaching the basin, overflow

Chapters include:

1—Removal of Screenings and Grit
2—Removal of Fine Suspended Matter
3—Oxidation of Sewage
4—Activated Sludge Treatment
5—Sludge Digestion and Gas Utilization
6—Disposal of Screenings and Sludge
7—Use of Chemicals
8—Treatment of Industrial Wastes
9—Pumps for Sewage and Sludge
10—Sewers and Sewer Materials
11—Equipment for Operation Control
12—Maintenance of Sewers
13—Construction Equipment and Materials
14—Refuse Collection and Disposal

Just Out



A Great Help When Working On Sewerage and Waste Disposal Projects

THE SEWERAGE MANUAL tells about every type of equipment and material you can use in designing sewers, sewage treatment plants, industrial waste plants, incinerators and refuse disposal systems.

A Complete File In One Compact Volume

A large number of products are illustrated as well as described. The Manual tells what each product can be used for and gives the names and addresses of all manufacturers so you can easily obtain more information if you desire. Divided into chapters as shown above, for easy reference, this Manual is the standby for designing engineers all over the nation.

Has Many Uses

Here are a few of the ways engineers tell us they use the Sewerage Manual:

1—To keep abreast of latest improvements

2—To find who makes the products you need

3—As reference in office discussions on equipment

4—To help explain equipment to councilmen and other non-technical officials

There is no other book like the Sewerage Manual. Its distribution is strictly limited to engineers who have a use for it. If you received the 1949-50 edition recently, *you have the most useful reference book available on this subject.* Be sure to use it regularly. No more copies of this edition are available.

You Always Find It In THE MANUAL

acids can't affect CLAY PIPE

VITRIFIED CLAY PIPE provides the only *sure* protection against costly, dangerous acid attack. "Inside and out," it's chemically inert — absolutely immune to corrosion, rust, or decomposition. In a recent survey of 122 leading American cities, it was found that 89% of the existing sewers are Vitrified Clay Pipe lines. *And there is not one instance on record of a single length of Clay Pipe wearing out due to acid attack.* It pays to play safe . . . to guard against the dangerous acids and alkalies found in sewage and ground waters. Be *sure* by specifying Vitrified Clay Pipe — the *only* pipe that never wears out.

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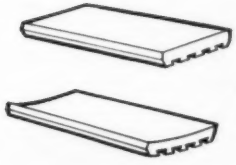

LINER PLATES

STANDARD-STRENGTH CLAY PIPE

CLAY PIPE FITTINGS

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weirs and tipping gates are provided at sewer junctions which divert excess sewage only when this reaches 20 to 54 times the estimated future dry-weather flow, which is estimated to occur not oftener than 6 times a year. Also the basin is divided into two parts; the smaller, with a capacity of 700,000 cu. ft., to receive the flow, overflowing into the larger one when it is full, which is not expected to occur more than once a year. It is expected that the smaller basin will retain practically all the suspended sewage matter and street washings and that the larger one therefore will seldom if ever need to be cleaned. The capacity of the pumps is adequate to empty the smaller basin in 18 hours and both of them in 60 hours.

Frederick W. Crane—"Retention Basin Eliminates Need for Costly Storm Sewers. *Engineering-News-Record*, Dec. 22.

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Contractors Record (England)

Treatment of Gas Liquor. Dec. 21, Pp. 81-84.

Engineering News-Record

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Treatment, Equipment and Stream Pollution. Abstracts from papers before the Fed. of Sewage Works Ass'ns. Jan. 5, Pp. 38-41.

Public Works

Mechanically Stoked Incinerator for Alhambra's Wastes. By *Linne C. Larson*, Cons. Engr. January, Pp. 23-25.
How a Difficult Drainage Problem Was Solved. By *George E. Bean*, City Mgr., Pontiac, Mich. January, Pp. 26-27.
Sewage Treatment for Summer Camps and Hotels. By *John J. Baffa*, Cons. Engr. January, Pp. 37-38.
Meter and Sewage Personnel Relationships to Health Departments. By *Earnest Boyce*, Chrmn, Dept. of Civ. Eng., Univ. of Michigan. January, Pp. 45, 68.

Sewage and Industrial Waste Engineering

Design Factors in Dual Disposal. By *Kenneth W. Cosens*, Asst. Prof. of Civ. Engr., Univ. of Texas. January, Pp. 15-18.
Saddle-Bag Tractors Save Labor in Moving Sewage Sludge. By *Walter A. Sperry*, Supt. Aurora San. Dist. January, Pp. 19-21.
Industry Tells How It Handles Wastes Treatment Problems. January, Pp. 22-23, 38.
Dual Fuel Engines for Sewage Plant Power Development. By *Nicholas Polakov*, Mech. Engr., Bur. Sew. Disp., New York City. January, Pp. 24-27.
Diffuser Plates Flame-Cleaned at Wards Island Sewage Plant. By *J. C. Kerr*, Linde Air Products Co. January, P. 27.
Tracing Passage of Pollution by Use of Fluorescein. January, P. 28.

The Surveyor (England)

Design of Small Sewage Works. Discussion. Dec. 9, Pp. 733-735.
Relation of Storage to Storm Water Pumping Rate. By *L. B. Escrit*. Dec. 16, Pp. 739-740.
Improvements in Systems of Combined Sewerage. By *R. C. Carter*. Dec. 16, Pp. 743-745.

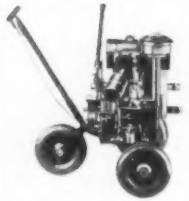
Water and Sewage Works

Measuring the Strength of Sewages and Trade Wastes: B.O.D. or O.C.? By *R. S. Ingols* and *J. C. Hildebrand*, Ga. Inst. of Technology, and *G. M. Ridenour*, Univ. of Mich. January, Pp. 21-27.
Chromium Removal by Ion Exchange. By *Don E. Bloodgood* and *Aubrey Strickland*, Purdue University. January, Pp. 28-32.
New Bladeless Sewage and Trash Pump. By *R. C. Glazebrook*, Fairbanks, Morse & Co. January, Pp. 41-45.

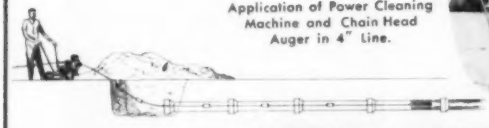
Activated Carbon Lengthens Filter Runs

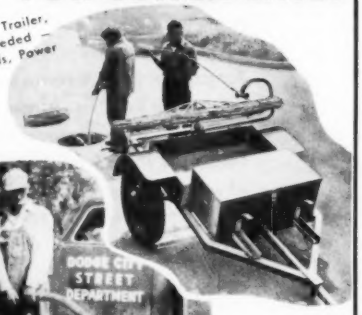
Under this heading John R. Baylis, Chicago's Engineer of Water Purification, writes an article for "Pure Water" (the monthly publication of the South District Filtration Plant) describing the use of powdered activated carbon in that plant for taste and odor removal. They have found that it also helps produce longer filter runs by increasing the removal by sedimentation of microscopical organisms. Such organisms have a specific gravity of practically 1.0, so settle only when combined with heavier particles (such as mineral turbidity)

PIPE CLEANING TOOLS
FOR WATER LINES
FOR SEWER LINES


Above "Flexible" Power Driven Pipe Cleaning Machine. Fast, Powerful, Safe.

Efficient Chain Head Cleaning Auger. A Power-Driven Tool.


Application of Power Cleaning Machine and Chain Head Auger in 4" Line.


"Flexible" Carry-All Trailer, packs everything needed — Rod Reel, Steel Rods, Power Drive, etc.

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When you need special information—consult READERS' SERVICE DEPT. on pages 93-97.

by coagulation. Lake Michigan has very low turbidity most of the time, but the lack is supplied by the carbon, whose specific gravity probably exceeds 2.0. During July 1949 an average of 53 lb. of activated carbon per mg was applied and the microorganisms were reduced from 1652 per cc to 85, and the turbidity from 21.6 to 0.9. It is believed that the reduction without carbon would have been between 70 and 80%, leaving five times as many organisms in the influent to the filters and greatly shortening the length of run. They figure that, during the comparatively few days in a year of short filter runs, it may be cheaper to use activated carbon for increasing sedimentation than to obtain the same result by high lime treatment.

Laying Water Mains in Milwaukee

The procedure for laying water mains in Milwaukee, Wisc., was described by Joseph P. Schwada, City Engineer, in the December Journal of the American Water Works Association.

The contractor is required to excavate to below the grade line of the pipe. Before the pipe is laid, the subgrade is prepared by backfilling to grade with an approved material, which is tamped to provide a continuous bearing and support. The approved material is sand, gravel or a loam clay. After the pipe is laid to grade, additional approved material is placed and compacted by tamping from the bottom of the pipe to the centerline of the pipe.

When this procedure was adopted, it was decided to measure the amount of settlement obtained after the pipeline is laid and the trench backfilled to the subgrade of the pavement. The amount of settlement is found by taking levels on the pipeline before and after the trench is backfilled. After the pipeline is laid to grade, levels are taken in back of each bell. Valve boxes are then installed behind each bell and the trench is backfilled. Later levels are taken periodically through the valve boxes and the amount of settlement is obtained. The department has made observations up to the present on 54-, 42- and 12-in. pipe, and has obtained some interesting information on the amount of settlement for the different sizes with various depths of backfill tamped under the pipe and with several kinds of backfill material. It has been found that the settlement is greater with the large pipe but is quite uniform within each size, that it is greater with a larger depth of backfill material tamped under the pipe, and that it is less with a cohesive material like loam and clay than with a material like sand.

For 54-in. pipe and a 4-in. layer of compacted sand, a fairly uniform settlement of 0.07 ft. (13/16 in.) was observed. With a 2-in. layer of compacted sand, this settlement was reduced to 0.06 ft. (¾ in.). With a 1-in. layer of compacted sand placed on top of a 2-in. layer of compacted clay, the settlement observed was 0.05 ft. (⅝ in.). In each instance, the trench bottom was a blue clay.

With a 42-in. pipeline and 4 in. of compacted sand, a fairly uniform settlement of 0.06 ft. (¾ in.) was observed. With 3 in. of compacted sand, the settlement was reduced to 0.05 ft. (⅝ in.); and with 2 in. of compacted sand, to 0.04 ft. (½ in.). In these instances, the trench bottom was sand or red clay.

With a 12-in. pipeline and 3 in. of compacted sand, a settlement of 0.02 ft. (¼ in.) was observed. The trench bottom was a dry red clay.

Interior view of American-Moninger glass enclosure erected at Sing Sing Prison, Ossining, New York during summer of 1949.

Make a "Good Neighbor" of Your Next Sewage Disposal Plant

Better "public relations" for your new sewerage plant are assured by the improved appearance and lessening of odors, insects, etc., that follow use of glass enclosed sludge and filter beds. These detailed advantages are:

1 Quicker sludge drying through independence of weather.

2 Continuous drying keeps all treatment processes "in step," adding greatly to reliability of operation.

3 Economy results from reducing size of beds, more batches dried in a given time.

4 Prevention of insects, and confining of odors, to create impression of good sanitation.

5 Improved appearance by covering sludge beds, sprinkling filters, and even clarifiers help make your plant a "good neighbor."

Write for Catalog GE-31 with details and specifications

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PUBLIC WORKS DIGESTS

THE HIGHWAY and Airport Digest

Intersection Channelization

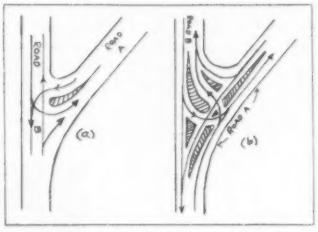
Channelization is the establishment of traffic channels within, and upon the approaches of, intersections to control the speed and path of vehicles. Through channelization, the places of conflicts between intersecting traffic streams may be controlled and the time element influenced, to promote safe and orderly intersecting traffic movements.

At intersections traffic may cross or merge; if the former, intersecting at right angles is desirable. If the traffic streams merge, this should be at an angle of less than 10° if possible; but the cost of this, using merging lanes, weaving chambers or traffic circles, is not justified at most intersections.

Drivers may be forced to reduce speed by "bending" the channel—reducing the radius of turn. Minor traffic streams should be bent more than the major ones. Left turns should be controlled by channelization to prevent drivers from cutting corners. Acceleration and deceleration lanes for turning traffic will minimize interruption of smoothness of flow of through traffic. Without channelization, large intersectional areas become regions of confusion, where each driver must battle his own individual way through the intersection.

Traffic channels may be designated by signs, pavement markings, contrasting surface color, roughened pavement areas, stanchions and raised islands. Raised islands and stanchions are physical barriers which tend to confine vehicles to their proper channels. When traffic islands are used to protect pedestrians or to "shadow" turning vehicles, the barrier types are recommended to prevent or discourage encroachments.

The best channelization designs on the drawing board may develop imperfections when placed in effect on the street. Permanent construction such as curbs, raised islands, etc., cannot be easily changed and therefore should not be attempted until after the channelization scheme has been tested by traffic. For this reason, channelization should, at first, be placed in effect with temporary islands. Portable stanchions, wooden platforms, bags of sand and other movable objects may be used to construct islands which may be changed in shape and location as dictated by traffic demands. Surface paint markings are not as desirable for this purpose. Drivers may cross over paint lines rather than follow prescribed paths requiring them to reduce speed or suffer even slight inconvenience.



Courtesy Traffic Quarterly

● ***How to handle merging traffic.***

Fred W. Hurd—"The Designing of Intersection Channelization": *Traffic Quarterly*, January.

Water Troubles in Cuts and Fills

Relocation of a section of U. S. 10, 40 miles north of Eureka, Calif., involved making a cut that reached a depth of 220 ft. and the removal of 376,000 cu. yd. The side slopes were made 1:1, with benches 25 ft. wide at 60 ft., 120 ft. and 180 ft. above roadway grade. Considerable free moisture was encountered in the material, a graphitic schist, and it was decided to try to drain this off to prevent slides. A series of drains were installed just above the floor of each bench as it was reached in the excavating. Holes were drilled on a draining grade extending an average distance of 130 ft. back from the face of the cut, one hole extending a maximum of 207 ft., and 2" perforated black pipe was inserted into the holes to prevent cave-ins. Twenty-three of these drains were installed, and water flowed from all but one, the maximum flow per pipe being 21,500 gpd. The flow decreased, but 14 were still flowing three months later at a total rate of 4,450 gpd. The 21,500 gpd flow decreased to 2,150 in 22 hours, and to 720 gpd in four days, indicating that that drain tapped a pocket and also a water-bearing stratum. In general, as each bench and its holes were reached, the flow at the higher levels decreased noticeably.

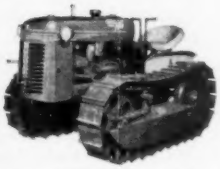
Earth from this cut is used for making a fill just north of it, about 4,000 ft. of which was in wet, swampy, unstable ground, where firm bottom is as much as 40 ft. below ground surface. To permit the escape of water which would be squeezed out by the fill, a blanket of sand 2 ft. to 5 ft. thick was spread on the ground and the fill deposited on it at a specified maximum rate—not more than one foot depth in 24 hours nor 3 feet in one week, to allow the soft ground to compress gradually and uniformly. A check upon the settlement of the fill was observed by the sinking of platforms built at ground level prior to placing any fill, and the escape of water was measured by pressure gauges buried in the foundation. On four occasions the consolidation and stabilization of the foundation, as determined by the gauges and platforms, was less than seemed desirable and placing of fill was suspended for a few days. The fill was carried a maximum of 3 ft. above finished grade and is still settling. The total settlement 140 days after the start of filling had been between 2.5 and 2.7 ft., about 0.25 ft. during the last 39 days.

L. R. Redden—"Freshwater Lagoon Excavation and Fill work;" *California Highways*, November-December.

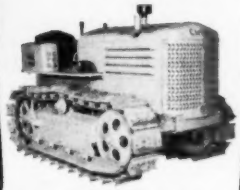
Dummy Joints For Concrete Pavements

A method of constructing concrete pavements suggested by the author is to use no expansion joints; use a felt-strip dummy joint slightly submerged below pavement surface at 10-20 ft. intervals; when a hairline crack appears above the strip, widen it into a groove ¾" wide and deep, and seal with thermoplastic material. It is suggested that the felt strip be about 1/16" thick and 2½" to 3½" wide, and be submerged ⅛" to ¼" below the surface. The hair crack can be cleaned and grooved with a

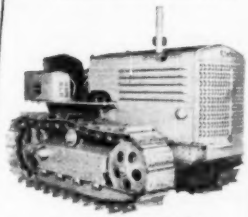
take your pick of PERFORMANCE



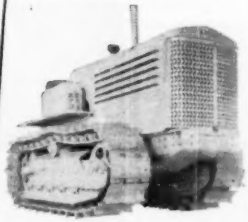
OLIVER-Cletrac Model HG



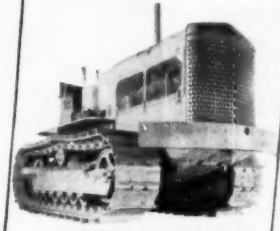
OLIVER-Cletrac Model A



OLIVER-Cletrac Model B



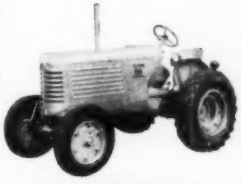
OLIVER-Cletrac Model D



OLIVER-Cletrac Model F

OLIVER "60" Industrial

OLIVER "77" Industrial



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mechanical joint-cleaning machine. It is recommended that rubberized asphalt be used for sealing, poured with a squeegee-bottom pouring lip. This plan can be used for the center line joint, and the groove be poured with white or yellow thermoplastic material filled with reflective glass beads or other reflective material.

Lloyd Hale—"Can New Joint Cleaning and Sealing Techniques Reduce Cost of Pavement Maintenance;" *Roads and Streets*, December.

Cost of Producing Crushed Stone

Linn County, Iowa, uses about 80,000 cu. yd. of crushed stone a year for resurfacing, some of which is done by contract but most of the stone is crushed by its own portable crushing and screening plant.

Before a quarry is opened, a preliminary study is made to determine the extent of the overburden and the thickness of usable rock. Test borings are made and a layout of the quarry site is plotted, with earth and stone contours indicated, along with estimated quantities of stone and stripping. Sites are selected to provide a short haul within each of the four highway maintenance districts, with the maximum haul approximately 8 miles. Each quarry set-up is designed to produce 20,000 cu. yd. of crushed material.

Stripping is done with a bulldozer. Drilling with a wagon drill and compressor. A ¾ yd. power shovel and two 1½-ton trucks handle stone to the crusher. The quarry is operated by 8 men—a shovel operator, 2 powdermen, 2 truck drivers, a feeder, a man for checking and loading, and a foreman. Complete cost records are kept. In 110 operating days in 1948 and 1949 one quarry produced 20,587 cu. yd. of stone, with costs as follows:

Item	Total Cost	Cost Per Cubic Yard
Labor	$8,194.69	$0.3980
Crusher	3,870.00	0.1879
Shovel	2,420.00	0.1175
Compressor and wagon drill	1,773.30	0.0861
Tractor with bulldozer	1,050.00	0.0510
1½-ton trucks in quarry	1,450.40	0.0704
Pickup trucks	849.60	0.0412
Dynamite and other supplies	1,250.67	0.0607
Workmen's compensation insurance, old-age and survivors' insurance, etc.	561.99	0.0272
Total	$21,420.65	$1.0400

"Quarry Operation Guided by Careful Cost Records;" *Better Roads*, December.

Equipment for Patching in Los Angeles

Maintenance of bituminous pavements in Los Angeles County became a major problem in 1913, when most vehicles were horse-drawn. Since the introduction of motor equipment the County has kept its equipment up to date, and as developed at present the road betterment program uses asphaltic plant mix, with the work performed by four or five special crews equipped with a truck, two motor graders, two rollers and incidental equipment. The trucks are particularly adaptable to patching that is extremely intermittent and scattered over an extensive mileage.

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Compound Melting Furnace
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Easy Way to cut SUB-GRADE STABILIZATION COSTS
Where pavement, sidewalks, curbs or gutters are beginning to settle, Koehring Mud-Jack is an easy, low-cost answer to your problem. This handy unit pumps inexpensive soil-cement slurry into small holes drilled through slab . . . raises structure to original level . . . leaves firm, lasting sub-grade support.
NO INCONVENIENCE TO PUBLIC . . . no traffic detours necessary. Koehring No. 10 Mud-Jack, illustrated, is ideal for city work . . . portable as a wheelbarrow. Bigger No. 50 Mud-Jack is also available for preventive maintenance or repairs on highways. For complete information write to
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They are of the 10-ton-chassis type with a six-man enclosed cab, back of which is mounted a 350-gal. insulated oil tank. The exhaust line from the truck engine is passed through the hot-oil tank, keeping the material at a temperature of approximately 400 deg. constantly. A by-pass valve is used in the event that the temperature rises above the required level. Oil-spraying is accomplished by the use of a gear pump driven by a power take-off from the truck transmission. The necessary aggregate in various sizes is carried on a flat bed back of the oil tank. One specialized maintenance truck will normally care for the patching of 400 miles of roads. This is made possible by the plan of organization of our betterment program.

E. A. Burt—"Special Trucks Speed Patch Jobs;" *Better Roads*, December.

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Quarry Operation Guided by Careful Cost Records. December, Pp. 17-19, 42.

Special Trucks Speed Patch Jobs. By *E. A. Burt*, Road Com'r., Los Angeles, Calif., Road Dept. December, Pp. 20-21, 40.

Reducing Winter Maintenance Costs. December, Pp. 31-34.

California Highways and Public Works

Freshwater Lagoon Excavation and Fill Work Are Features of Humboldt Project. By *L. R. Redden*, District Office Engineer. November-December, Pp. 12-14, 47.

Boost for Freeways. By *Robert L. Bangs*, Right-of-Way Agent. November-December. Pp. 29-33.

Erosion Control: Methods Used on California State Highways. By *H. Dana Bowers*, Supervising Landscape Architect. November-December, Pp. 36-41.

Public Works

Winter Maintenance in the Nation's Capital. By *William A. Xanten*, Supt. of San., D. C. January, Pp. 28-30.

Roads and Bridges

Highway Capacity Studies as a Guide to Economic Design of Roadways. By *O. K. Normann and W. P. Walker*, U. S. Bureau of Public Roads. December, Pp. 64-66, 83-88.

Cost of Operating Shovels, Draglines, Clamshells and Cranes. December, Pp. 71-74, 98.

Roads and Streets

Three-Contractor Team Paves Detroit-Wayne Major Airport. December, Pp. 13-18.

Day Labor Construction—When Justified. By *Archer B. Gay*, Sec.-Treas. Virginia Road Builders Ass'n. December, Pp. 19-20.

Scraper Production: Job Data Summarized by Research Committee Report. December, Pp. 26, 28, 30.

"Super Multi" Pipe Culverts Placed by Assembly Line Methods. By *Lindsay F. Root*, Asst. Engr., New Mexico H'way Dept. December, Pp. 34-35.

California Highway Engineers Develop Own Power Soil Sampler. By *A. W. Root*, Sr. Phys. Testing Engr., Calif. Div. of H'ways. December, Pp. 38-39.

Can New Joint Cleaning and Sealing Techniques Reduce Cost of Pavement Maintenance? By *Lloyd Hale*, G. H. Tennant Co. December, Pp. 40-41, 62.

Baltimore's "Operation Asphalt" Paved 14 Blocks of an Arterial Street in One Day. By *Walter R. Macatee*. December, Pp. 49, 52, 55, 57, 59.

The Surveyor (England)

Road Surfacing by Mechanical Method. By *H. S. Taylor*, Nottinghamshire Divis. Surveyor. Dec. 2, Pp. 715-717.

Traffic Quarterly

The Designing of Intersection Channelization. By *Fred W. Hurd*, Prof. Yale Bureau of Highway Traffic. January, Pp. 89-101.

Cost of Laying Water Mains

On thirty-six water main jobs, involving 22,992 ft. of 6-inch water pipe, 104 specials, 27 gates and 33 hydrants, the St. Paul, Minn., Water Commissioners report a total average cost of $3.28 per ft. Labor amounted to $1.37 per ft. and materials to $1.91. This pipe was laid during 1948. For the same period, 2,630 ft. of 8-inch, with 23 specials, 3 gates and 2 hydrants, averaged $3.54 per ft., ranging from $3.15 to $4.09. The cost on 1,405 ft. of 12-inch averaged $5.70 per ft., labor amounting to $1.62. On 1,950 ft. of 16-inch, the total cost averaged $7.52 per ft., with labor at $2.23. Comparable costs for 1947 were, for 6-inch $2.77 per ft., and for 8-inch $3.27.

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THE WATER WORKS DIGEST

Radioactivity in Water Works Practice

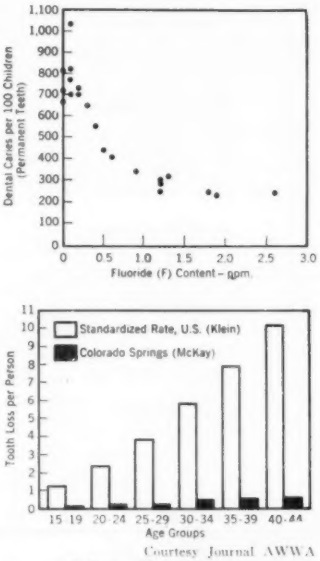
The new and rapidly growing atomic energy industry has ramifications of importance to the waterworks profession, which therefore should inform itself not only on the destructive possibilities of nuclear forces, but also on the possibility of using them as an effective tool. This will require that water technicians receive training in nuclear physics, analytical techniques and interpretation of results. Like chemistry and bacteriology, the field of nuclear physics has a terminology of its own. For example, 1.0 ppm of any item is expressed as 1.0×10^{-6}. Acquaintance with the methods and instruments used to detect the radioactive contamination of water, and with the control procedures necessary for laboratory research on radioactive materials are essential features of the training for applying this rapidly developing science to the waterworks field.

Arthur E. Gorman—"Radioactivity—A New Factor in Water Works Practice;" *Journal, Am. Water Works Ass'n*, December.

Fluoridation of Public Water Supplies

The A.W.W.A. in 1949 gave official acceptance to the practice of water fluoridation for the purpose of reducing tooth decay. In August of that year, 40% of the states had adopted a definite policy regarding fluoridation. Seventeen installations were in operation in 9 states, 14 had been approved and 20 were under consideration. The first experimental study was inaugurated in Grand Rapids, Mich., in January 1945, but it is considered that positive evidence of its effect requires 8 years of continuous use, since this is the duration of permanent tooth formation in children. However, in the opinion of the Wisconsin State Bd. of Health, the results of less than three years of fluoridation at Sheboygan demonstrates that this has reduced caries about 20%.

About 1.0 to 1.5 ppm of fluoride ion in water is believed to be desirable, and since many waters contain some before treatment, only enough is added to bring the total up


Dental Caries per 100 Children (Permanent Teeth)
Fluoride (F) Content – ppm
Tooth Loss per Person
Standardized Rate, U.S. (Klein)
Colorado Springs (McKay)
Age Groups
15-19 20-24 25-29 30-34 35-39 40-44

Courtesy Journal AWWA

● ***Adding fluoride to water.***

to this amount. The commercial salt of sodium fluoride is generally used, but one municipality uses hydrofluoric acid, and consideration is being given to sodium silicofluoride, which is a by-product of the manufacture of phosphates and costs only about ¼ as much per unit of fluoride ion. The cost of fluoridation ranges from 5¢ to 15¢ per capita per year.

Harry A. Faber—"The Status of Fluoridation in 1949;" *Journal, Ameican Water Works Ass'n*, December.

In Charlotte, N. C., and in no other city apparently, the addition of 1.0 to 1.5 ppm fluoride resulted in a tremendous increase in the cracking of manufactured ice, which greatly reduced its sales value. Another consideration is the fact that mineral salts in water solution are forced to the central core during freezing, and the solid-frozen core may contain as much as 25-30 ppm fluoride.

Zachary M. Stadt and Robert S. Phillips—"Effect of Fluoridated Water in Ice Manufacturing;" *Journal, American Water Works Ass'n*, December.

Chlorine Dioxide As a Bactericide

The water system of Niagara Falls, N. Y., contains mains over 50 years old which contain considerable deposits. Sudden reversals of flow due to fluctuating demands for water by large industries stir these deposits up, and cause chlorinous tastes, although there are none in the chlorinated water as it leaves the treatment plant. In an attempt to control these tastes in 1948, chlorine dioxide was added to the filtered water as it entered the distribution system, but tastes and odors occurred at intervals. A thorough study showed that in the great majority of cases samples from the distribution system having an odor contained 0.05 ppm or more of free residual chlorine. In April, 1949 post-treatment with chlorine dioxide was stopped and changed to pretreatment sufficient to maintain a chlorine dioxide residual of 0.5 ppm prior to filtration. The filtered water was treated with sufficient chlorine to maintain 0.2 ppm of free chlorine residual, later reduced to 0.15 ppm, and finally discontinued altogether, as it was found that pretreatment with chlorine dioxide alone provided 0.15 ppm of free chlorine residual in the filtered water.

Fred V. H. Piper—"Chlorine Dioxide as a Bactericidal Agent;" *PUBLIC WORKS*, January.

Softening Water by Aeration

The English Water Pollution Research Board has been investigating the effect of aeration on the temporary hardness of water, to ascertain whether it would cause precipitation of calcium carbonate at a rate sufficiently high to make the process economical on a large scale. One advantage would be reducing by 50% the amount of sludge produced by the lime process. It seemed necessary to add nuclei for the deposition of calcium carbonate removed from solution. Using precipitated chalk for this purpose, they found 500 to 4,000 ppm was necessary to give good results, but this chalk could be used over and over;

that used ten times has been more efficient each time. But the cost of the process, including the considerable amount of aeration required, seemed higher than the reduction of hardness obtained warranted.

"Softening Water by Aeration;" *Municipal Engineering*, Dec. 9.

Antibiotics in Water Analysis

The use of lactose broth as a presumptive medium is inadequate because of false positive results and false negative. The former are obtained when non-coliform organisms produce acid and gas in the broth in 48 hr.; the latter when non-coliform organisms overgrow the coliforms and prevent gas production or coliform isolation in the confirmatory medium once gas has been produced by coliforms. The writers experimented with the addition of penicillin and tyrothricin to lactose broth as antibiotic substances, and it was concluded that modifications in the present formulation of the antibiotic media will have to be made if they are to be of practical value in water analysis.

Sydney C. Rittenberg and John H. Silliker—"Use of Antibiotics in the Presumptive Medium for Water Analysis;" *Am. Journal of Public Health*, December.

Jacking Pipe Filter Under River

A perforated 5″ steel pipe 127 ft. long was placed under a stream in Switzerland by packing a 6½″ casing from a 10 ft. diameter shaft on one shore to a 5 ft. shaft on the opposite shore, then pushing the 5″ pipe through this in 4'11″ lengths welded together, and then withdrawing the outer casing. This method, patented by Hans Fehlmann, is similar to the Ranney method used in this country, but the latter jacks the perforated pipe itself and leaves it in.

"Jack Pipeline Under River Bed;" *Engineering News-Record*, Jan. 5.

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Wichita, Kans., Enlarges Well Supply. January, Pp. 94-96.

American Journal of Public Health

Use of Antibiotics in the Presumptive Medium for Water Analysis. By *Sydney C. Rittenberg* and *John H. Silliker*, Asst. Prof. and Instructor, Univ. of So. California. December, Pp. 1553-1560.

Engineering News-Record

Jack Pipe Line Under River Bed. Jan. 5. P. 44.

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Public Works

How Water Hammer and Pipe Line Surges Can Be Controlled. By *John Howard Dawson*, Assoc. Prof. of Civ. Eng., Oklahoma Inst. of Tech. January, Pp. 31-33, 68.

Chlorine Dioxide as a Bactericidal Agent. By *Fred T. H. Piper*, Dir. of Water Dept., Niagara Falls, N. Y. January, Pp. 46, 48.

The Surveyor (England)

Reducing Water Consumption in Times of Shortage. By *C. F. J. Lisle*. Dec. 2. P. 719.

Water and Sewage Works

Developments in the Water Works Field During 1949. By *A. P. Black*, Pres. A.W.W.A. January, Pp. 1-9.

Water Treating Experiences. By *A. H. Ulrich*, Supt. of Water, Austin, Tex. January, Pp. 10-12.

Chlorine Dioxide Treatment at Valparaiso, Ind. By *Richard Coots*, Supt. of Filtration. January, Pp. 13-16.

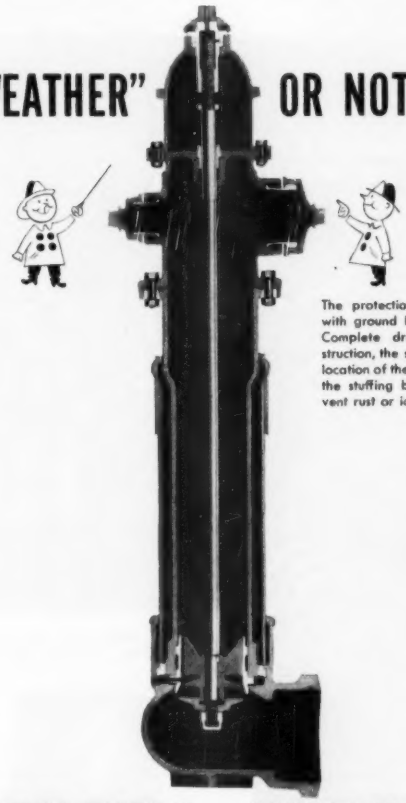
American Water Works Ass'n Journal

Radioactivity—A New Factor in Water Works Practice. By *Arthur E. Gorman*, San Engr., Atomic Energy Comm. December, Pp. 1053-1060.

The Status of Fluoridation in 1949. By *Harry A. Faber*, Chemist Chlorine Inst. December, Pp. 1061-1068.

Effect of Fluoridated Water in Ice Manufacturing. By *Zachary M. Stadt*, Dir. of Preventive Dentistry, N. C. Health Dept. and

"WEATHER" OR NOT



The protection case is free to move with ground heaves caused by frost. Complete drainage, leakproof construction, the shield operating nut, and location of the operating thread above the stuffing box, all combine to prevent rust or ice from forming.

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Robert S. Phillips, Chf. San. Engr., Water Dept., Charlotte, N. C. December, Pp. 1069-1070.

The Installation of Cast-Iron Water Mains. By *Joseph P. Schwada*, City Engr. Milwaukee, Wis. December, Pp. 1071-1077.

Tentative Standard Specifications for Installations of Cast-Iron Water Mains. Approved Nov. 14, 1949. December, Pp. 1079-1112.

Tentative Standard Specifications for Reinforced Concrete Water Pipe—Steel Cylinder Type, Prestressed. Approved Nov. 21, 1949. December, Pp. 1113-1128.

Water Works Engineering

Cincinnati's Expansion Program. By *E. A. Farmer*, Cons. Engr. December, Pp. 1088-1091, 1127.

Sanitary Status of Nebraska Water Works Rated on Defects. By *T. A. Filips*, Div. of Sanitation, Nebr. Dept. of Health. December, Pp. 1092-1120.

Power Shovel Sizes

(*Continued from page 53*)

unit times the trips made per hour by each is the maximum hourly yardage capacity of the hauling fleet. If this exceeds materially excavator capacity, the number of hauling units or their capacity may be decreased.

Hauling Unit Size and Standbys

With a 3-yd. truck under a ¾-yd. excavator, which has a cycle time of 20 seconds, an empty haul unit must be ready every 80 seconds. This is difficult to do for 60 minutes every hour. A 4½-yd. unit, taking 6 dippers would be better, and a unit would need to be spotted every 2 minutes. If the length of haul indicates that each truck is to make 6 trips per hour, 5 trucks are needed to service the shovel. However, on a tight schedule like this, if one truck fails, 20% of the production is lost. Assuming a theoretical output of 135 yards per hour, there is a loss, if one truck goes out of service, of 27 yds. per hour. At 50¢ per yd., this amounts to $13.50 per hour, which will fully justify the addition of a standby unit. Moreover, having a standby unit on the job, also permits better servicing and maintenance. Also, it is better not to have the schedule too tight. The excavator is the producing equipment, and every effort should be made to keep it working all of the time.

The data given here are typical of the information available in this Bulletin in respect to planning and management of the hauling fleet. These points have been considered briefly in this article, but only for the purpose of calling attention to the various important factors that must be considered. Requests for Bulletin No. 3, addressed to the Editor, will be forwarded to the Power Crane & Shovel Ass'n.

The World's Biggest Dragline

An English firm, Ransomes & Rapier, Ltd., is building what is believed to be the largest and most powerful walking dragline in the world. The boom, of tubular construction, will be 292 ft. long and will carry a 20-yd. bucket. It will be powered by an electric generator set with driving motors totaling 3,000 hp. It will cost over $1,000,000. The purchasers, Stewarts & Lloyds, Ltd., of Corby, England, will use it for removing iron ore overburden.

Putting Copper Heating Coils In an Old Digester

The plant digester at the Valley City, N. D., sewage treatment plant needed new heating coils, so the tank was emptied. Quite a lot of gravel was found in the bottom of the tank and this, too, had to be removed. Then the new copper pipe for the heating coils was installed. Providing adequate ventilation inside the digester for the workmen was one of the many problems encountered in doing the work. Roy Main is plant operator.

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"NO SUCH THING AS A 'BAD FREEZE-UP', JOE, WITH THE SIMPLICITY OF BUFFALO'S FROST BOTTOM METERS."
AMERICAN (Bronze Case) WATER METERS
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JIM: *"Of course. These other materials are cheaper."*

JOE: *"But you know they won't resist corrosion as long as Everdur—you're going to have to replace them eventually."*

JIM: *"We-e-ell . . ."*

JOE: *"Then there's the fact that Everdur costs less to fabricate. It's easy to work and machine."*

JIM: *"Yeah?"*

JOE: *"Sure. And don't forget, built-up assemblies are lighter . . . easier to operate. That cuts costs."*

JIM: *"Okay, okay. You win. I guess we will be money ahead to use Everdur all around."*

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Above-The-Ground Clear Well for Filter Plant

The location of the new 4,000,000 gpd water treatment plant at Bartlesville, Okla., in the flood area of the Caney river, made it impossible to utilize a conventional design of plant with the clear well underneath the filters. A 1,000,000-gal. welded steel storage tank, furnished by Chicago Bridge & Iron Co., has been installed instead, to serve as a clear well. This makes it possible to operate the treatment plant during flood periods.

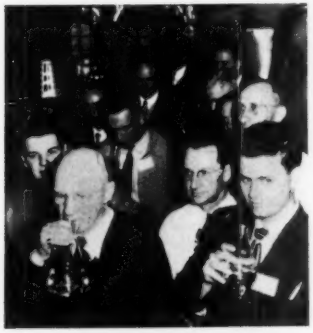
The new clear well is 60 ft. diam. by 48 ft. high and has an umbrella roof. It is located at the new treatment plant in the northern part of the city. There is also a 400,000-gal. elevated tank in the distribution system, a short distance southwest of the geographical center of the city.

Bartlesville obtains its raw water supply from two sources—Lake Hudson, which is located 5½ mi. to the northwest, and the Caney river, in the northeast corner of the municipal limits.

The water from the Caney river is highly saline because of pollution from oil wells in its drainage area. The water from Lake Hudson is used to dilute the Caney river water and thus reduce the chloride content. Raw waters from the two sources are mixed in the proper proportions and then softened in the new treatment plant. The treated water is pumped into the 1,000,000-gal. clear well by a 2 mgd electrically-driven pump. One 1.3 mgd and two 2 mgd electrically-driven high-lift pumps re-pump it into the pipe lines at 75 lbs. per sq. in. pressure. The City also has a 4 mgd diesel-powered stand-by unit for emergencies.

Tennessee's Schools for Water Works Operators

The attendance at the four December schools for water works operators in Tennessee set a new attendance record with 156. The 15th annual school, at the University of Tennessee in Knoxville was held Dec. 5 to 8. Short schools for operators of smaller plants were held in Knoxville, Nashville and Jackson. For the voluntary certification program, 73 operators submitted examination papers. These schools are conducted by the Division of Sanitary Engineering, Tennessee Department of Public Health, in cooperation with the Division of Ex-



Making threshold odor test at Tenn. Operator School.

tension, College of Engineering, University of Tennessee, and were directed by J. Wiley Finney, Jr., principal sanitary engineer of the State Health Department.

Ohio Water and Sewage Operator Certification

Examinations for operator certification for both water and sewage treatment will be held by the Ohio Dep't. of Health on Friday, April 28, at Massillon, Cincinnati, Cleveland, Columbus and Toledo. Applications, which must be filed before March 18, can be obtained from G. A. Hall, 301 Ohio Departments Bldg., Columbus, O.

Conventions and Meetings

The New Jersey Sewage Works Association will hold its annual meeting at Trenton, N. J., March 22-24, at the Stacy-Trent Hotel. M. S. Kachorsky, PO Box 283, Manville, N. J., is secretary.

The National Council for Stream Improvement meets in New York City, at the Waldorf-Astoria Hotel, Feb. 20-22. Council address is 271 Madison Ave., N. Y.

The Fourth Congress on Large Dams will be held some time during 1951 at New Delhi, India. Information is available from G. A. Hathaway, 4316 Van Buren St., Hyattsville, Md.

Monthly and Annual Rainfall for 112 Years

Data have been maintained by St. Paul, Minn., of monthly and annual rainfall for 112 years, or since 1837. Average rainfall over these years is 26.98 ins. Rainfall during 1948 amounted to 26.88 ins. By months, beginning with January, average rainfall for the 112 years, follows: 0.91; 0.84; 1.42; 2.26; 3.41; 4:15; 3.25; 3.25; 3.17; 1.98; 1.40; and 0.95.

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PERSONAL NEWS

Clarence I. Sterling, who has been Director of the Division of Health and Sanitation of the Institute of Inter-American Affairs, and previously its chief engineer, has resigned to become Director of the Massachusetts Division of Sanitary Engineering and Deputy Commissioner of Health for Environmental Sanitation.

Russell L. Johnson is now Division Engineer of the Michigan State Department of Health, with offices at Escanaba, and will represent the Department in the entire peninsula.

Herbert M. Bosch has been appointed chief of the Section of Environmental Sanitation for the World Health Organization, with headquarters at Geneva, Switzerland. Col. Bosch has been in charge of sanitation and sanitary engineering for the Minnesota Department of Health since 1946, when he succeeded Harold A. Whittaker.

Ernest W. Steel joins the University of Texas this month to take charge of the Sanitary Engineering curriculum and allied research. Before the war, Col. Steel was at Texas A & M College as professor of Municipal and Sanitary Engineering; until recently he has been in South America.

D. C. Greer, Texas State Highway Engineer, has reorganized the highway department better to handle the increased volume of work. Three chief engineers have been appointed —**Herbert Eldridge** to handle planning; **John A. Waller** to handle construction and maintenance; and **Russell J. Hank** to handle operations.

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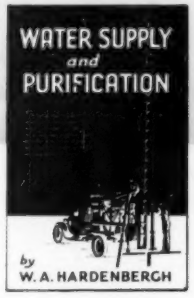

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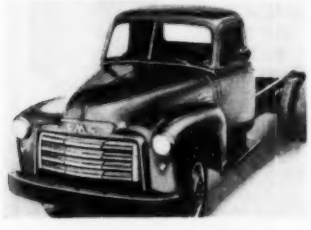
Use coupon on page 93; circle No. 1-2

GMC Truck Development for 1950

More horsepower in the light and medium trucks will be one of the features of GMC 1950 motor trucks. New models have been introduced in the 1½ and 2½-ton ranges, and two new 6-wheelers in the heavy range; also two new and lighter diesel tractor series. The new 280 series will be an addition to the 1½-ton group, while in the 2½-ton list, the new 470 series will be added.



New 280 Series GMC truck.

There are many improvements in body design and new airplane type double acting shock absorbers are added on all light duty models. These trucks are now on exhibition at all GMC dealers.

Use coupon on page 93; circle No. 2-2

Steel Replacement for Wooden Bridge Floors

A new structural plate steel bridge flooring is available to replace wooden flooring on highway bridges, overpasses and viaducts. The section

Replacing a bridge floor.

is a 2-inch deep trapezoidal corrugated type, with a laying width of 33 ins., and lengths of 6, 8, 10 and 12 ft. It eliminates maintenance common to wood floors, reduces the dead load and simplifies bituminous surfacing, either hot or cold mix. Data from U. S. Steel Fabricators, Inc., Wooster, Ohio, or use the coupon.

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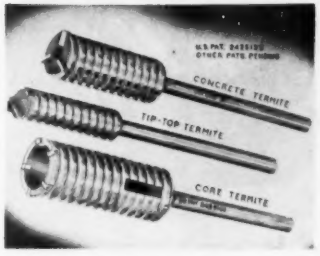
New Type Concrete and Masonry Drill

For boring accurate and perfect holes in concrete, tile, brick, or other masonry, there are three kinds of "Termite" drills. These use a



How to drill tile and concrete.

rotary, pulverizing action which eliminates heating, permits longer useful life of drills and maintains the gauge. These drills can be used in any electric drill or air motor which has a ½-inch chuck. Write Concrete Termite Drill Co., 2099 Foothill Blvd., Pasadena 8, Calif., or use the coupon.

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Throws Snow Off Sidewalks and Driveways

For snow removal from skating rinks, yards, sidewalks, parking places, and similar areas, this snow thrower is fine. It is a self-propelled rotary plow, with a 7.2-hp engine, which cuts a path 28 ins. wide, moves at the rate of 120 ft. per minute, and throws the snow up to 50 feet away. The operator can regulate the distance of throw. Said to handle any kind of snow, wet or dry, level or in drifts. Write Maxim Silencer Co., Hartford 1, Conn., or use the coupon.

Use coupon on page 93; circle No. 5-2

Throws snow off walks.

Loader to Bulldozer in 30 Minutes

This unit permits the use of one tractor and a minimum number of conversion parts to function as either a bulldozer or a loader. The change can be made in 30 minutes. Among the jobs recommended are highway and street maintenance; sand, gravel and aggregate handling; grading and backfilling. More information from Southwest Welding & Mfg. Co., Alhambra, Calif. Ask for Bulletin CM-11, or use the coupon.

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Loader—bulldozer unit.

A Better Brush for Street Sweeping

A plastic brush for all rotary street cleaning equipment is said to wear four to six times as long and to save much money in bristling operations. The bristles are of Permene, which is flexible and resilient, and easy to install on the rolls. It does not absorb water. Write Modglin Co., Inc., Los Angeles, Calif., or use the coupon.

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A Metering Dispenser for Banox

To insure adding the recommended amount of rust inhibitor to salt, an attachment is now available which is used with the "Scotchman" chemical spreader, to add the inhibitor in the proper quantity while the spreader is in operation. The dispenser has a capacity of 23 pounds of Banox. When not needed, it may be dismounted. Information from Tarrant Mfg. Co., ,Saratoga Springs, N. Y., or use the coupon.

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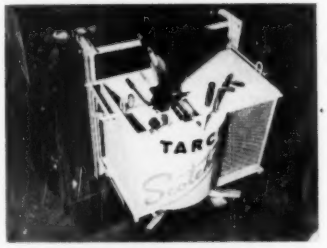

Rust inhibitor dispenser.

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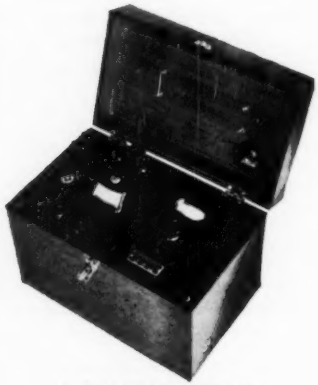

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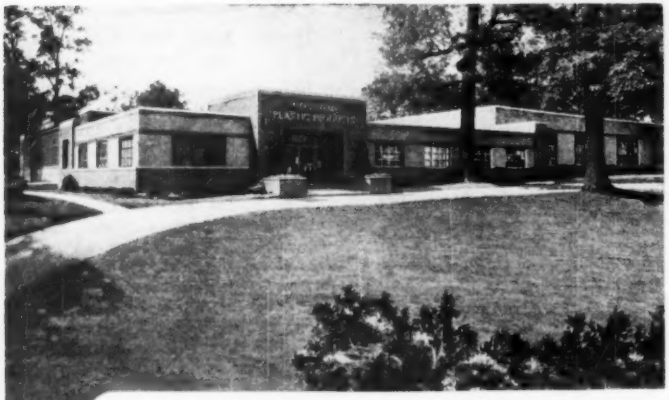

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For spraying roadsides for weed control, this 4-ft. boom is available to treat swaths up to 40 ft. wide. Droplet size is large enough to minimize drift of the spray. Nozzle clogging does not occur. The boom can be added to equipment now in use. For full data write Hansen Chemical & Equipment Co., Beloit, Wisc., or use the coupon.

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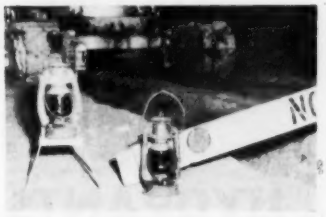

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Snow Plow and Light Bulldozer

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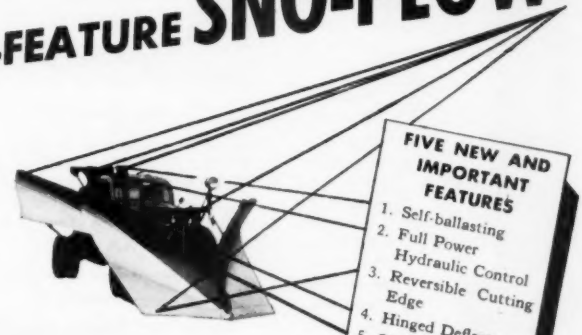

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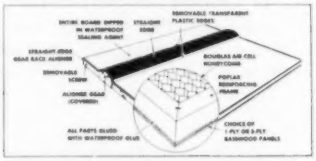
This is a drawing board of honeycomb or air-cell type, of extreme lightness, strength and rigidity, with special warp-resistance and transparent, plastic, removable straightedges. A gear-rack aliner eliminates the need for T-square. Made in sizes from 12 x 17 to 31 x 42. Cal-Pan Corporation, 1111 S. Fremont Ave., Alhambra, Calif., will send data, or use the coupon.

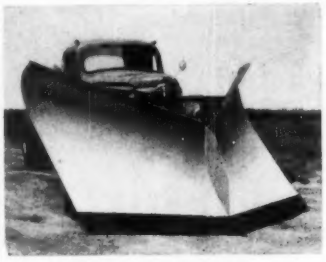


New Type Drawing Board.

Use coupon on page 93; circle No. 2-14

Jarp V-type Snow Plow

The Jarp V-plow is especially designed for breaking through deep snow and widening heavy drifts. The curved moldboards and heavy construction insure fast work and quick discharge. In addition to the V-type plows, Jarp makes one-way rigid and one-way reversible plows. Cutting widths to 8.5 ft. are provided. Write Jarp Corp., Wausau, Wisc., or use the coupon.



Jarp Snow Plow.

Use coupon on page 93; circle No. 2-15

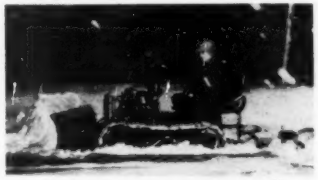
Valves for Sludge and Heavy Liquids

These valves are designed primarily for handling sludge, paper pulp, slurries and similar heavy liquids. They are of the quick-cleaning type, designed for 100 psi; commercially, but not totally tight. Lever handle control sizes, 4-inch to 12-inch; rising stem wheel control, 4-inch to 24-inch. Many other features make these valves excellent for sewage plants. More data from W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn., or use the coupon.

Use coupon on page 93; circle No. 2-16

Mighty Mouse—The Baby Bulldozer

For grading, excavating, snow removal, backfilling and similar work here is an 800-pound crawler bulldozer. Bucket is 3½ cu. ft. A "tote" wagon is available in which the bulldozer can ride to work and with which it hauls and handles dirt. Drawbar pull is 800 pounds; crawler treads are 7 inches wide; speeds up to 6 mph, forward and reverse. New catalog shows many uses. Sent on request to Mead Specialties Co., 4114 North Knox, Chicago 41, Ill., or use the coupon.



"Mouse" Gnawing At Snow.

Use coupon on page 93; circle No. 2-17

Quickway Half-Yard Shovel

The new Model L Quickway is a ½-yd. power shovel or 10-ton crane, equipped with a heavy-duty folding type boom. With additional attachments, this unit can operate as a trench hoe, dragline or clamshell. The basic machine weighs 5 tons. Data from Quickway Truck Shovel Co., Denver, Colo., or use the coupon.

Use coupon on page 93; circle No. 2-18

A 6½-Ton Mobile Crane and Shovel

Though it is termed a crane, this unit can be equipped with shovel, trench hoe, clamshell or dragline. It is mounted on rubber and has air brakes, air steering and either 2 or 4-wheel drive. Control is wholly from within the cab. As a shovel, bucket capacity is one-half yard. Full information from Hansen Clutch & Machinery Co., Tiffin, O., or use the coupon.

Use coupon on page 93; circle No. 2-19

Moving Materials Cheaper

This is a heavy duty small truck, built like a tractor, which has an 18-cu. ft. body for handling materials, and can be equipped also with a platform body. Speeds to 15

Kalamazoo material mover.

mph. Carries up to 3,000 lbs. Only 7 ft. long and half as high. Very short turning radius. Details from Kalamazoo Mfg. Co., Kalamazoo, Mich., or use the coupon.

Use coupon on page 93; circle No. 2-20

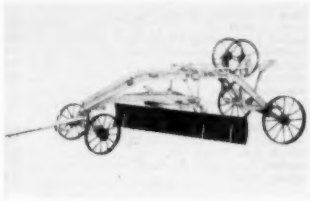
A Shoulder Maintainer For One-Pass Work

Pulled by a standard industrial wheel-type tractor, this machine has many advantageous features. It is a one-pass machine. The front mold-board reaches the outer edge of the shoulder, and cuts, blades and rolls the material inward, eliminating high spots. The side and transfer mold-boards deliver the excess material to the rear, eliminating windrows. Operation is hydraulically controlled. The machine is made in 8-ft. to 14-ft. sizes. Write Lull Mfg. Co., 3612 E. 44th St., Minneapolis 6, Minn., or use the coupon.

Use coupon on page 93; circle No. 2-21

A Small Pull Grader for Light Highway Maintenance

The No. 4 Hi-Way patrol pull grader is handled through Caterpillar distributors. With an 8-ft. blade and a wide range of adjustments, this grader has been most useful on rural roads, ditching, erosion control, terracing, snow removal and grading. It may be pulled by a small track or wheel grader, or by animals. More information from Preco Inc., 6300 East Slauson Ave., Los Angeles, Calif., or use the coupon.



Light highway patrol.

Use coupon on page 93; circle No. 2-22

Clarification and Oxidation in Water and Waste Treatment

An improved clarification unit for water and sewage treatment plants consists of a clarifier mechanism and a large central well in which aeration and sludge recirculation arrangement is provided. It is stated that, by mixing settled floc with the influent, a greater solids surface is provided so that finely suspended matter is adsorbed from the liquid, resulting in improved clarification, increased floc size and better settling. At the North Stockton sewage treatment plant, conversion to an oxidator increased suspended solids removal from 60% to 78% and 5-day BOD from 25% to 45%. This unit was invented and designed by Process Engineers, Inc., of San Francisco.

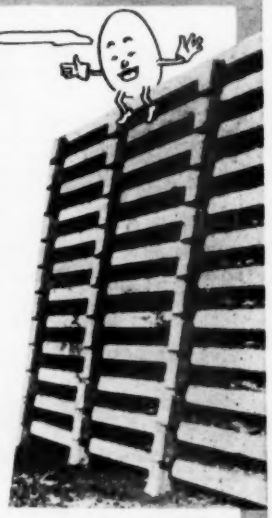
Use coupon on page 93; circle No. 2-23

like Humpty Dumpty . . .

Old ideas and costs take a tumble

when you build retaining walls of Universal Concrete Cribbing

If you have retaining walls to build, investigate this thoroughly proved, fast, economical method. Pre-cast concrete cribbing is easily laid up by unskilled labor with perfect results. Minimum preparation — no footers, no forms, no drainage problems — maximum beauty and efficiency result. Build it straight or curved, to any height. It's permanent as the pyramids yet 100% salvagable if removed. Hundreds of installations prove its versatility and complete success under practically all conditions.



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NEW LISTINGS

How To Eliminate Pumping Stations With Submersible Pump Units

23. Ten big advantages of submersible deep well turbine pump and waterproof electric motor units include pump house elimination, permitting installation in park or residential areas where pump house structures would not be acceptable. Available pump types cover various heads and wide capacity ranges. Complete data in Bulletin No. 49-5200 published by Byron Jackson Co., Dept. PW, Los Angeles 54, Calif.

Water Level Controls for Sewage and Water Plants

31. Dependable float-operated pump and motorized valve controls for single or multiple pump installations are described in bulletins issued by the Water Level Controls Div., Healy-Ruff Co., 719 Hampden Ave., St. Paul 4, Minn. All units feature splash proof construction, mercury tube switches.

How the Versatile "Payloader" Can Speed Public Works Jobs

32. The endless number of material handling jobs facing Highway and Public Works Departments require the best in modern machinery. Carrying dirt and backfill, loading snow, grading and bulldozing are a few of the many applications of Hough Payloaders shown in Bulletins 172 and 173. Get copies from Frank G. Hough Co., Dept. PW, Libertyville, Ill.

Municipalities Make Equipment Dollars Go Further

55. Be sure to get your copy of "Saving Facts" a new illustrated booklet prepared by The Oliver Corp. that shows how equipment dollars can be stretched on municipal work. Text and photos describe the application of tractors and money-saving attachments in street maintenance, snow removal, waste disposal, pipe laying and other projects. Write The Oliver Corp., Industrial Div., 19300 Euclid Ave., Cleveland 17, Ohio.

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves is contained in several bulletins published by the company. Construction details and special contrl features are illustrated. Write W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn.

"Silent Hoist" Equipment For Public Utilities

118. The complete line of Silent Hoist winches for trucks and tractors, "Krane Kars" with orange-peel and clamshell buckets, derricks and telescoping towers, all of interest to municipalties and utilities, are illustrated and described in Bulletin 54. Get a copy today from Silent Hoist & Crane Co., 844 63rd St., Brooklyn 20, N. Y.

"A Decade of Duraplastic Air-Entraining Cement"

121. This is the title of an illustrated booklet which tells the development of Portland Air-Entraining Cement from its initial use ten years ago to its present acceptance by highway engineers. Copies will be available shortly. Reserve yours now by using coupon or write Universal Atlas Cement Co., Dept. PW, Chrysler Bldg., New York 17, N. Y.

Blades for Roadside Mowers Sharpened Automatically

138. Get full data on the Boyer Automatic Sickle Sharpener that will help you keep razor-sharp edges on sickle blades for your roadside mowers, and save you time by doing the job automatically. Use coupon or write Boyer Industries, Inc., 3415 Lakeside Ave., Cleveland 14, Ohio.

Heating, Thawing and Melting With Hauck Burner Equipment

142. A newly released 16-page bulletin covers the complete line of Hauck heating and melting equipment. Data covers units for every water, sewer and street department purpose, from "one-man" burners to large size portable kettles. A useful addition to your reference file. Get Bulletin 1068 from Hauck Mfg. Co., 117-127 Tenth St., Brooklyn 15, N. Y.

Painting Water Tanks For Longer Protection

149. High labor costs demand special consideration when painting elevated water tanks. This and other factors involved in proper paint selection are discussed in a bulletin issued by Jos. Dixon Crucible Co., Jersey City 3, N. J. Helpful specifications for repainting water tanks are also included.

Aeration and Degasification For Your Water Supply

167. Diagrams, complete description of operating principles and typical specifications for cascade, coke tray and pressure aerators, degasifiers and decarbonation units are published in a new 12-page water conditioning bulletin. Write General Filter Co., Dept. PW, Ames, Iowa.

Superior Features for Municipal Power Plants

168. Optional use of by-product gases, such as sewage sludge gas, stamina and precision construction, fuel economy and conservative rating are some of the noteworthy features of Superior Diesel Engines, described in Bulletin 4812. For a copy write The National Supply Co., Superior Engine Div., Springfield, Ohio.

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169. The Bolens Huski Power-Ho offers year-round use with straight and V-plow attachments for winter, sickle-bar and lawn mower units for summer months. Heavy pneumatic tires and rugged power unit on tractor. Be sure to investigate this handy equipment. Bolens Products Div., Dept. PW., Port Washington, Wisc.

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137. Tested under severest conditions of long, hard use, these engines have earned world wide recognition as the "right" power for hundreds of applications. Get latest bulletin from Dept. PW, Briggs and Stratton Corp., Milwaukee 1, Wisc.

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154. Operating on the Diesel cycle, burning either oil or gas, the Worthington Supercharged Dual Fuel Diesels give high economies by running on the cheapest fuel available. Get complete data from Worthington Pump & Machinery Corp., Dept. PW, Harrison, N. J.

Compact Power Unit Leaves More Room for Equipment

177. When you are cramped for space compact diesel power units can save a lot of trouble. Investigate General Motors diesel power for pumping plants or wherever dependable, easy-starting engines are needed. Write Dept. PW, Detroit Diesel Engine Div., General Motors, Detroit 28, Mich.

Listings Continued on Pages 94 to 97

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20. This really helpful booklet tells you a lot about hypochlorination of water for small and medium sized supplies, swimming pools and main sterilization, and fully describes the application of manual and automatic "Chem-O-Feeders" for constant or proportional feeding of chemicals. Send for Bulletin SAN-8 issued by Proportioneers, Inc., 96 Codding St., Providence 1, R. I.

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25. One-man operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., 2050 Columbia Ave., Rockford, Ill.

Is Your City Metered 100%?

33. 100% metering as practiced by many cities requires accurate, dependable meters with interchangeable parts. Cut-away views of every part, capacity and size data are all included in handsome American-Niagara water meter booklet available from Buffalo Meter Co., 2920 Main St., Buffalo 14, N. Y.

Data on Modern, High-Rate Water Treatment Plant

40. This handsome 28-page bulletin gives a comprehensive yet understandably written story of the development of the Accelator, and explains its principles, advantages, design considerations, operation and applications. Helpful flow diagrams and specifications. For a copy use the coupon or write Infilco Inc., 325 W. 25th Place, Chicago 16, Ill. Ask for Bulletin 1825.

Flow Meters With Many New Features

91. The new Propelflo meter for main-line metering introduces many new features you will want to look into. Send for latest bulletin today. Builders Providence, Inc., 16 Codding St., Providence 1, R. I.

Tested Jointing Materials

102. "Hydrotite" is a self-caulking, self-sealing joint compound for bell and spigot pipes. For data book and sample write Hydraulic Development Corp., 50 Church St., New York, N. Y.

Well Water Systems Built to Last

105. Layne pumps are built for wells ranging from 4" to 36" diameter and in capacities from 50 to 16,000 gpm. Full engineering data and many installation views are given in 32 page Pump Bulletin 4-42. Layne and Bowler, Inc., Memphis, Tenn.

All of These Booklets Are FREE, and Many Are of Great Value. To Order Those You Need in Your Work Use the Coupon on Page 93.

Eliminate Taste and Odor From Your Water

53. Technical pub. No. P.W. 213 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with Break-Point Chlorination. Sent free to any operator requesting it.

Helpful Data on Swimming Pools

59. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., 335 Josam Bldg., Cleveland 15, Ohio.

Cast Iron Pipe and Fittings For Every Need

65. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Dept. PW, Burlington, N. J.

88 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 88 page booklet. W. A. Taylor & Co., 7304 York Road Baltimore 4, Md.

Job Data Offered on New Steel Water Lines

80. A 12-page illustrated report listing pipe diameters, pipe wall thicknesses, line pressures, coatings, engineering personnel, etc., is entitled "A Report of Dresser-Coupled Steel Water Lines in the Year 1948." A copy will be sent by Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

How to Estimate Quantity Of Joint Compound Needed

87. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer joint compound are described in bulletins issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Helpful Data on Hydrants

64. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Dept. P.W., Anniston, Ala.

Pressure Pipe That Retains Capacity

106. Several bulletins describing the construction of pressure pipe, list of installations, carrying capacity tests, making service connections under pressure; and detail descriptions of several installations. Lock Joint Pipe Co., Box 269, East Orange, N. J.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

Specs for Gate Valves

112. Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Handy Catalog Describes Small Hydrants, Drinking Fountains

115. This 32-page catalog describes ¾" to 2" hydrants. Also street washers, drinking fountains and other water service devices. The Murdock Mfg. & Supply Co., 426 Plum Street, Cincinnati 2, Ohio.

Do You Ever Have Leaks to Fix?

124. You'll want to know about the full line of "Skinner-Seal" clamps for repairing bell and socket joint leaks and broken mains. Step-by-step procedures are illustrated in catalog 41, a handsome 40-page presentation which shows applications of all fittings. Write M. B. Skinner Co., Dept. PW, South Bend 21, Ind.

The Modern Way to Filter Swimming Pool Water

129. That's the title of a bulletin full of facts about Bowsers' new diatomite filter to produce clear, sparkling, clean water at low cost. Occupies small space, doesn't waste water. Gives sizes to use, performance charts, etc. Write Bowser, Inc., Dept. PW, 1395 Creighton Ave., Ft. Wayne, Ind.

All About Cement-Mortar Lining of Water Mains

133. Here, in a really beautiful booklet, is practically everything you need to know about this method of lining mains in place—

the needs, methods, and results that will interest you. Centriline Corp., Dept. PW, 140 Cedar St., New York 6, N. Y.

How Elevated Water Tanks Can Save on Operating Costs

134. Beautiful new booklet on Horton elevated steel water tanks suggests ways to reduce pumping costs, increase capacity of systems, maintain uniform pressure, etc. Illustrates 7 models of welded, ellipsoidal-bottom, elevated steel tanks in full color. Write Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4, Ill.

"Tailor-Made" Pumps Fit Your Requirements

156. Application-Engineered vertical turbine pumps to suit your particular pumping requirements are completely described in Bulletin P-178. Details of optional driving and pumping arrangements clearly illustrated. Get your copy from A. O. Smith Corporation, Dept. PW, Milwaukee 1, Wisc.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

SEWAGE AND REFUSE

How to Keep Trenching Jobs on Schedule

24. The easy maneuverability of the tough, compact Cleveland Model 95 "Baby Digger" makes it well suited for the difficult job of trenching past the many obstacles of city and suburban work. Multiple digging and crawler speeds handle all soil types and trench widths up to 24". Get Bulletin S-52 from Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

USE COUPON ON PAGE 93 *TODAY* TO ORDER THE LITERATURE YOU NEED.

How to Lower Costs Of Refuse Collection

35. For saving trucks, labor and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Bros., Inc., 996 Higgins, Knoxville 17, Tenn.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass.

Solve Corrosion Problems With This Special Alloy

41. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. Dept. P.W., the American Brass Co., 25 Broadway, N. Y. C.

Design Details for Sludge Collectors

42. Booklet No. P.W. 1982 on Link-Belt Circuline Collectors contains sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, illustration pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

A Handbook of Sewer Cleaning Equipment and Methods

46. A new, fully illustrated 40-page booklet shows every sewer cleaning operation with "Flexible" tools. Includes data on the fast and easily operated new Sewe RodeR and full engineers' specifications for power bucket machines. For your copy write Flexible Sewer Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.

All Electric Floatless Liquid Level Control

78. Description of operating principles and applications of B/W controls shows the simplicity and many uses of these all-electric, floatless devices. Diagrams of typical installations and engineering data all in bulletin 147 issued by B/W Controller Corp., Dept. PW, Birmingham, Mich.

Engineering Facts About Transite Pipe

83. This compilation of Johns-Manville's "Engineering Facts" series presents concise, factual information about Transite's many economic and engineering advantages, and includes informative case histories plus dimensions and data for your files. Write Johns-Manville, Box 290, New York 16, N. Y., or use the handy coupon.

How Cities Can Do Complete Sewer Cleaning From Street

98. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Power machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

Complete Catalog for Engineers Shows Sewage Plant Equipment

110. A complete, 44-page catalog gives engineering data on Jeffrey equipment for water, sewage and industrial waste treatment plants including screening, screenings grinders,

1. Easier To Transport, (Nestable).
2. Easier To Handle and Set!
3. Easier To Drive—By Hand or Sheeting Hammer!
4. Easier To Pull Without Distortion!
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Cuts Construction Costs Six Ways!
TWO TYPES
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CORR-PLATE
STRONGEST per pound weight
Contractors and Engineers *Depend* on CORR-PLATE Steel Piling to *Reduce the Cost of Construction on Your Job!*
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Write For Your Copy TODAY—Shows how CORR-PLATE *is used on Your Job. Gives complete Specifications for Standard and Interlock Sections. All Type of Construction Shown — All Accessories and Specials listed. (Contractors, Engineers, Executives—Don't Wait—Write Today!)*
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2121 S. STATE STREET • CHICAGO 16, ILLINOIS

grit collectors and washers, settling tank collectors, feeders, Floctrols, mixers and other mechanical equipment. Use coupon to get Catalog 775-A, Jeffrey Mfg. Co., Columbus 16, Ohio.

How to Improve Coagulation and Sludge Conditioning

111. "Ferri-Floc," description and instructions for use in coagulation, sludge conditioning and treating industrial wastes, fully treated in a 24-page pamphlet. Tennessee Corp., 619-27 Grant Bldg., Atlanta 1, Ga.

Need Low-Cost Air For Sewage Treatment?

122. New 20-page booklet shows operating and construction features of Rotary Positive Blowers engineered to fit your needs. Air for activated sludge, water treatment; constant vacuum for filtering. Bulletin 22-23-B-13 gives details. Roots-Connersville Blower Corp., 310 Poplar Ave., Connersville, Ind.

An Incinerator Necessity

139. Recuperators featuring silicon carbide heat transfer tubes and fireclay corebusters for maximum efficiency are described and illustrated in Bulletin 11 issued by Fitch Recuperator Co., Dept. PW, Plainfield Natl. Bank Bldg., Plainfield, N. J.

Standard Translot Blocks For Filter Underdrains

145. Proper filter underdrainage is extremely important. Specifications and installation details for transverse slot filter underdrains made of durable vitrified clay are available from Texas Vitrified Pipe Co., Mineral Wells, Texas.

The Vacuum Filter In Your Home Town

182. That is the title of bulletin F-2005 issued by The Eimco Corp. Data on dewatering sewage sludge by actual installations are included. Write Eimco Corp., Salt Lake City 8, Utah.

Underdrains—Hidden But Important Filter Components

113. For filter bottoms this firm makes "Armcre" vitrified salt glazed floor blocks which provide ducts occupying 50% of the floor cross-section and air openings aggregating over 24% of the floor area. Described in several leaflets and data sheets. Ayer-McCarel-Reagan Clay Co., Brazil, Ind.

Data on New Single Stage Sludge Digestion Unit

163. High capacity mixing and ample gas storage space are provided in the new single stage digester type MA. Bulletin No. 6591 describes the unit and tells how it works. Photographs, drawings and useful tables of sizes and design data are included. Unit is available for tanks from 20 to 50 foot diameters. The Dorr Co., Barry Pl., Stamford, Conn.

Attractive Glass Enclosures For Sludge Drying Beds

164. Complete design details on American-Moninger glass sludge-bed enclosures are included in bulletin GE-31 issued by the American-Moninger Greenhouse Mfg. Co., 1820 Flushing Ave., Brooklyn, N. Y. This 24-page bulletin also shows a number of typical installations and furnishes complete specifications on construction details.

Seven Advantages of Sanitary Land Fills

171. Development of sanitary fills to lower sanitation costs and steps for the proper operation of these fills are described in bulletin 12314 titled "Lowering Health and Sanitation Costs" and issued by Caterpillar Tractor Co., Peoria 8, Ill.

Air for Activated Sludge and Other Aeration Processes

187. Quiet operation, high efficiency and compact size are features of the Chicago "Standardaire" positive displacement blower. Wide range of capacities available to fit your needs. Details and performance data from Chicago Pump Co., 2348 Wolfram Ave., Chicago 18, Ill.

SNOW FIGHTING

For High-Speed Snow Removal

44. "Frink One-Way Sno-Plows" is a four-page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow, Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

CONSTRUCTION EQUIPMENT

Solve Your Drainage Problems This Easy, Permanent Way

28. Useful new 60 page catalog on standard corrugated pipe, multi-plate pipe and arches and 18 other drainage and related products for culverts, sewers, sub-drains, flood control, airports, water supply and other types of construction. Ask for "Armco Products for Engineering Construction," Armco Drainage and Metal Products, Inc., Dept. PW, Middletown, Ohio.

Methods of Installing Steel Sheet Piling

30. Illustrated descriptions of both standard and interlock corrugated steel sheet piling of minimum weight, maximum strength, ease of handling with methods of installation are contained in a booklet. If you have a job involving piling write Caine Corr-Plate Piling Co., Dept. PW, 2535 S. State St., Chicago 16, Ill.

Federals Feature Lower Costs On Hauling Jobs

39. Heavy duty hauling ability for construction jobs and dependable power for maintenance work are built into all Federal trucks described in colorful new folder. A broader range of trucks covers models from medium to highest tonnage capacities. Full specifications from Federal Motor Truck Co., Dept. PW, Detroit 9, Mich.

Newly Improved
OK CHAMPION POWER SEWER CLEANER

DON'T LOSE Sewer Capacity

Clear your sewer lines regularly. Keep up full carrying capacity and you save money—in lower maintenance cost and avoiding costly backwash. Order OK Champion Power Sewer Cleaner equipment and your men remove roots, dirt and other obstructions from any storm or sanitary sewer in ONE operation. All men work above street level.

OK Champion cleaners are regularly clearing sewers all over the world. New improvements make them better than ever. Send for literature.

CHAMPION CORPORATION
Hammond, Indiana

GET FULL FACTS NOW!

CHAMPION CORPORATION, 4752 Sheffield Ave., Hammond, Ind.
Please send information on how the Improved OK Champion Power Sewer Cleaner cuts sewer cleaning costs.

NAME.....TITLE.....

ADDRESS.....

PLAN BETTER SEWER LINES

WITH WESTON GASKETS and FORMS for ALL SEWER PIPE JOINTS

• No jute used—gasket centers spigot. • Definite space in each joint for cement. • Form confines cement-grout to lower portion of joint. • Particularly advantageous in water-bearing trenches. • Infiltration minimized.

L. A. WESTON CO. ADAMS MASS.

Ready now

Reprints of

HOW TO GET FUNDS FOR ADVANCE PLANNING OF PUBLIC WORKS

Reprints are available now of Pere Seward's valuable article on this subject that appeared in the January 1950 issue of PUBLIC WORKS Magazine.

Send check for $5 for 50 or $8 for 100 copies to this magazine 310 East 45th St., New York 17, N. Y.

When you need special information consult READERS' SERVICE DEPT. *on pages 93-97.*

Speed Your Work With These Powerful Motor Graders

48. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

Data and Pictures of Complete Line of New Ford Trucks

58. Check this number on the coupon for colorful circular showing new Ford Trucks for every hauling need, available in great variety of standard, factory-built chassis and body combinations. Be sure to check these trucks on your job. Truck and Fleet Sales Dept., Ford Motor Co., Dearborn, Mich.

How to Pump Debris Laden Water

63. Bulletin 167-D describes the Novo lift-and-force diaphragm pumps which feature compact design, easily opened cleanout plate and triple-life diaphragms. 3" and 4" sizes handle water laden with large amounts of debris and abrasives, and containing large percentages of air. Copies from Novo Engine Co., Lansing 5, Mich.

Power Saw Speeds Pruning, Clearing

69. Don't wait until storms have broken limbs and felled trees before finding out about the new light-weight engine powered chain saw announced by McCulloch. Ideal for all contracting and tree-maintenance operations. Get bulletin from McCulloch Motors Corp., Dept. MP, 6101 W. Century Blvd., Los Angeles 45, Calif.

Tractors for Counties, Cities and Contractors

76. An attractive 24-page catalog portrays the Allis-Chalmers HD-5 crawler's abundant capacity and ability to meet the variable needs of counties, townships and contractors. Photographs and cutaway views illustrate its rugged construction and simplified maintenance. Use coupon or write Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wisc.

Drill Concrete With Your Ordinary Electric Drill

82. Substantial cost-per-hole savings are claimed for Tilden Rotary Drills which penetrate concrete 2" to 4" per minute. Cutters can be resharpened. Available in sizes ¼" to 4". Get full data from Tilden Tool Mfg. Co., 1995 N. Fair Oaks Ave., Pasadena 3, Calif.

How to Get Accurate Subsurface Information

172. For positive knowledge of sub-surface soil conditions an accurate sample is needed. The compact and complete Acker Soil Sampling Kit includes 12 soil and earth sampling tools. Get details in Bulletin 26. Acker Drill Co., Inc., Dept. PW, Scranton 3, Pa.

STREETS AND HIGHWAYS

Data Book on Universal Concrete Cribbing

21. Shows typical sections for designing walls, pictures many applications, specifications, etc. Get the facts today about this economical reinforced concrete cribbing. Universal Concrete Pipe Co., Dept. PW, 297 So. High St., Columbus 15, Ohio.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 10, Wis.

New Unit Cleans Catch Basins in a Jiffy

34. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass.

Latest Maintenance Equipment for Blacktop Roads

52. "Blacktop Road Maintenance and Construction Equipment"—Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

Useful Data on Tarvia Road Surfaces

94. For full information on the use of Tarvia paving materials for both construction and maintenance of glare-free, smooth-riding surfaces, check the coupon or write to the The Barrett Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

All of These Booklets Are FREE, and Many Are of Great Value. To Order Those You Need in Your Work Use the Coupon on Page 93.

52-Page Data-Packed Bulletin On Contractors' Pumps

95. Tables for pump size determination on every excavation job, pipe friction loss, attitude effects and lots of other valuable data are included in this comprehensive booklet illustrating the many Jaeger "sure-prime" pump applications. Get your copy (catalog P45) by checking our coupon or writing the Jaeger Machine Co., Dept. PW, Columbus 16, Ohio.

The Right Tractor For Your Job

116. Whether you need a front-end loader, snow plow, bulldozer, sweeper or mower, International wheel tractors combine correctly with allied equipment to do the job. Your choice of gasoline or diesel units is illustrated in Bulletin A-103JJ. International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

International Trucks Are Built to Take It

120. Trucks take a pounding in construction work—that's why you need data on International Trucks that are engineered for your job. Check the coupon or write International Trucks, Dept. PW, 180 N. Michigan Ave., Chicago 1, Ill.

Check "Gunite" Concrete For Every Application

158. Big 44-page book illustrates "Gunite" uses for both repair and new construction of sewers, tanks, dams, swimming pools, and all concrete structures. A multitude of applications. Be sure to check coupon or write Pressure Concrete Co., Dept. PW, 315 S. Court St., Florence, Ala.

Versatile Maintainer Has Year 'Round Usefulness

151. A new bulletin shows how the sturdy Huber Maintainer will work for you the year 'round on maintenance jobs, berm leveling, road planing, bull-dozing, snow plowing, brooming, mowing shoulders and as a patch roller. Good ideas on how to do all these jobs in Bulletin No. M-138. Write Huber Manufacturing Co., Dept. PW, Marion, Ohio.

How You Can Improve Your City's Street Cleaning

162. The Austin-Western Model 40 sweeper features three wheel design, front wheel steer, for easy maneuvering; rear broom to sweep dirt and refuse directly into 2-yd. hopper; built-in flushing device. Diagrams showing all operations and full specifications in Bulletin AD-2042, issued by Austin-Western Co., Aurora, Ill.

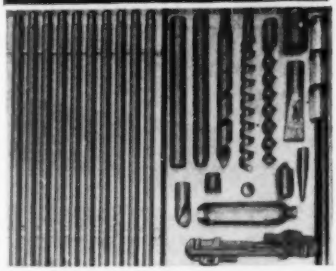
Data on All Types of Bins and Batching Plants

183. Good illustrations and useful data on all types of Heltzel Highway Bins, for truck mixer charging, bulk cement plants, enclosed bucket elevators, belt conveyors, etc. Heltzel Steel Form & Iron Co., Dept. PW, Warren, O.

Good Lawns a Must For Good Parks

193. For every step in lawn care and seasonable maintenance hints be sure to read "Lawn Care," an interesting periodical sent without obligation by O. M. Scott & Sons Co., 80 Spring St., Marysville, Ohio.

SOIL SAMPLING KIT



• 12 soil and earth sampling tools in handy steel box.

• Can be carried in any automobile.

30 years experience has proved these tools will recover accurate samples from practically all earth materials.

• MANY USES—brick and clay materials — foundation test borings — gold bearing sands — kaolin and clay for ceramics — sand and gravel pits — subgrade testing for highways and airfield runways — base materials.

• *Send for Bulletin 26*

ACKER DRILL CO., INC.
SCRANTON 3, PA.

"GUNITE"

FOR REPAIR OF

DAMS

Regardless of state of disintegration, dams can be repaired economically with a resurfacing of reinforced "Gunite."

• *YEARS OF ADDED SERVICE*

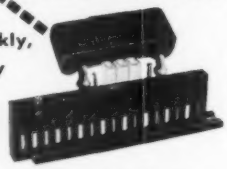
• *LOW MAINTENANCE*

Write for our 48-page Illustrated Booklet on "Gunite." It's Free

PRESSURE CONCRETE COMPANY
"Gunite Contractors and Engineers"
193 EMMET ST., NEWARK 3, N. J.
50 COURT ST., FLORENCE, ALA.
33 NO LA SALLE ST., CHICAGO, ILL.

on the spot CHLORINE DETERMINATIONS

made quickly, accurately with a



TAYLOR-ENSLOW SLIDE CHLORIMETER

The ideal instrument for determining the free or residual chlorine content of water, sewage or industrial wastes.

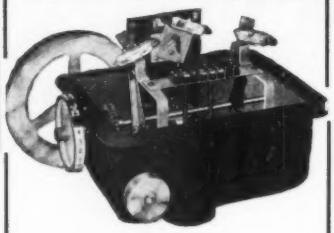
Taylor-Enslow slides are molded of durable plastic and contain a complete set of 9 sealed color standards. Two slides are available: 0.0 to 1.0 p.p.m. and 0.0 to 3.0 p.p.m. of chlorine. All Taylor liquid color standards carry an unlimited guarantee against fading. Combination pH and Chlorine sets, and complete Taylor Water Analyzer sets are also available. All sets are easily portable.

READ THIS INFORMATIVE BOOK

Write direct for "Modern pH and Chlorine Control"... gives valuable data for all water and sewage operators ... describes Taylor outfits. See your dealer for equipment.

W. A. TAYLOR AND CO.
7304 YORK RD. • BALTIMORE 4, MD.

ROTO-TROL



RF-2 with ALTO-TROL

Puts that second pump to work.

A 2-pump RF-2 ROTO-TROL with a built-in ALTO-TROL will operate each pump on alternate starting cycles, assuring equal use and wear of both pumps. Operates both pumps when required.

Depth Indicator optional—extra.

Write for full data.

Water Level Controls Division

HEALY-RUFF Company

791 Hampden Ave., St. Paul 4, Minn.

WORTH TELLING . . . By Arthur K. Akers

The still-expanding **Graver Water Conditioning Company,** 216 W. 14th Street, New York 11, announces as new representatives, J. R. Fortune & Son, Detroit; Stapp Engineering Co., Denver; Process Equipment Co., Tulsa; Brookman-Kron Associates, Buffalo 2; Fred S. Renauld Co., Los Angeles; and Russell R. MacDonald Co., Richmond 19, Va.

•

Walter H. Brown, formerly superintendent of the Cranston, R. I., sewage disposal plant, is now with **Builders-Providence Inc.** at Providence. He was president of the New England Sewage Works Association in 1949.

•

George L. Irvine, pictured below, is new Agency and Distributor Division manager for **General Electric.** This Division replaces the Apparatus Agency Division.

Mr. Ode

Mr. Irvine

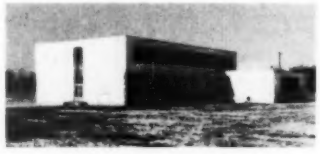
Kenneth F. Ode (above) is new manager of the Findlay Division of **Gar Wood Industries Inc.,** to give improved service on Buckeye Ditchers and Gar Wood Tractor Equipment.

•

Motorola Inc., Chicago, announces plans for a new research laboratory and specialized production building in Phoenix, Ariz. **Daniel E. Noble,** vice president, will be in charge. Uninterrupted year round testing afforded by the Phoenix climate prompted the development.

•

MacBeth Corporation, manufacturers of laboratory and scientific equipment for the water and sewerage fields, is now occupying the new plant at Newburgh, N. Y., shown below.



New MacBeth plant.

•

Appointment of **George F. Noltein** as director of research for **Superior Engine Division** at Springfield, Ohio, is just announced.

Mr. Noltein

Mr. Donahue

Mack Trucks names **J. M. Donahue** manager of its Atlantic Division, in Philadelphia; and **John J. Byrne,** manager of national accounts, in Atlanta.

•

Marlow Pumps, Ridgewood, N. J., keeps growing, and announces two more new district sales representatives: **A. F. Woods** at Birmingham, Mich., and **Ralph Thornburg** at New York with jurisdiction southward through Washington and Virginia.

•

The water works industry was shocked to learn of the sudden death in an Aurora, Ill., hospital of **A. W. McLean,** manager of **Layne Western Co.** at Chicago. He was an old-time member of the Layne & Bowler organization.

•

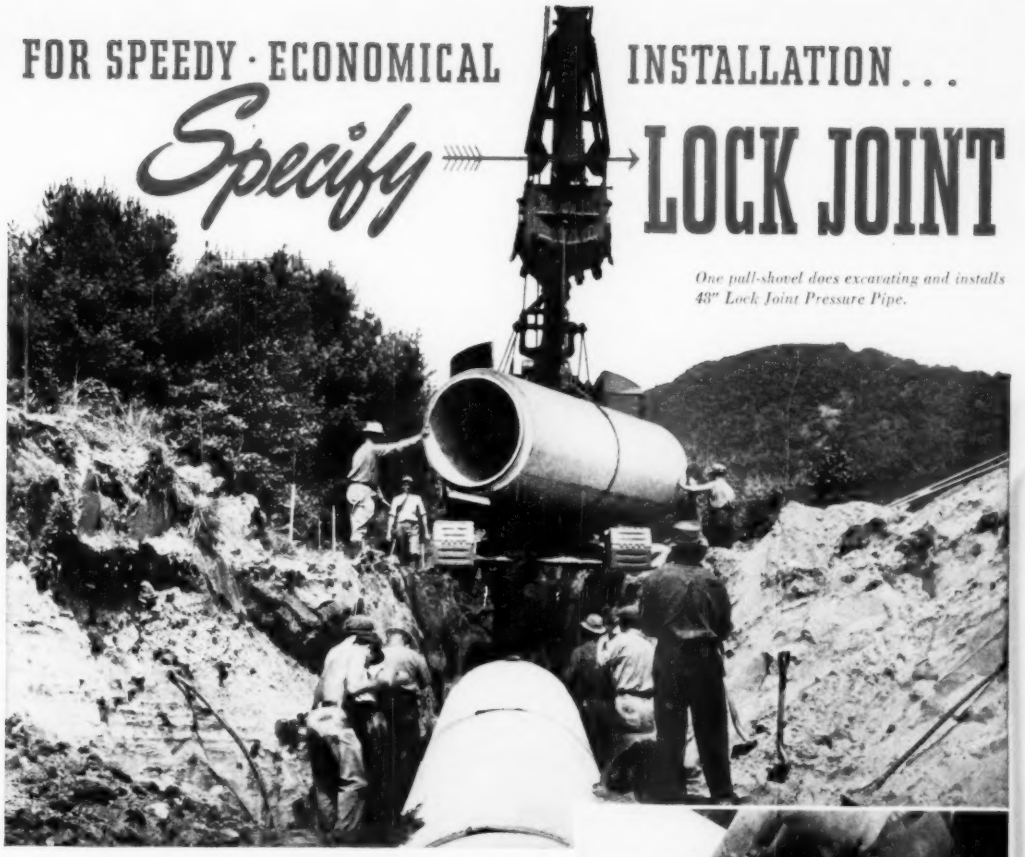
If your snow plows ever knocked over a fire hydrant buried in snow, you will be glad to know that our new friend **A. A. Lachance** of the **American Metal Products Co.** in Worcester 8, Mass., has the answer in their handy fire hydrant markers which stick up above the deepest snow. Ask him about it!

•

We laughingly share with you this from the **Universal Concrete Pipe Company's** PIPE DREAMS. A deep south election board was counting ballots. A Republican vote showed up. The board put it aside as suspicious only. Some hours later a second Republican ballot showed up. "Throw 'em both out!" thundered the judge. "The son-of-a-gun voted twice!"

FOR SPEEDY · ECONOMICAL INSTALLATION . . .

Specify LOCK JOINT



One pull-shovel does excavating and installs 48" Lock Joint Pressure Pipe.

Rubber and Steel Joint ready to be pushed home.

• • • With its exclusive Rubber and Steel Joint, Lock Joint Reinforced Concrete Pressure Pipe is installed rapidly and efficiently in extremes of heat or cold—in wet ditch or dry.

Only one machine is required to make the excavation and install the pipe. No caulking or bolting of the joint is necessary, and the pipe may be back-filled immediately. The Rubber and Steel self-centering expansion joint is flexible to accommodate ground settlement, and is watertight at any internal pressures common to American Water Works practice.

Today, millions of feet of Lock Joint Reinforced Concrete Pressure Pipe, equipped with the Rubber and Steel Joint, installed at low cost and needing little or no maintenance, are giving unfailing service throughout the Western hemisphere.

LOCK JOINT PIPE COMPANY

Est. 1905

P.O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J. • Turner, Kan. • Detroit, Mich.

BRANCH OFFICES: Cheyenne, Wyo. • Denver, Colo. • Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

8 YEARS AND STILL GOING STRONG

The ability of the Break-Point Process to meet the various demands of day by day operation is aptly shown by the case history of a municipal water works in Pennsylvania.

Since 1941, when it was installed at this plant by W&T Engineers, the Break-Point Process has played a major role in producing a pure, sparkling water for the system's many consumers. It has completely eliminated complaints on tastes and odors and has raised the finished water quality to such a high level that tests show *no* gas formers and *no* bacteria on the plates. In addition, a staff report continues, the Break-Point Process was of particular value in keeping the water acceptable to consumers during an emergency plant overload of 120%.

These accomplishments and such additional benefits as longer filter runs and iron and manganese removal are typical of what you receive with the Break-Point Process backed by W&T Equipment.

In the complete line of W&T chlorinating equipment, proved by over 35 years' experience all over the world, there is a chlorinator that will give *your* plant these benefits, too.

For more details write to your nearest W&T Representative—he'll be glad to help you.

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CHLORINE AND CHEMICAL CONTROL EQUIPMENT
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